TIER I AND II SUBSTANCE PROFILES
per
CANADA - ONTARIO AGREEMENT
respecting
THE GREAT LAKES BASIN

Update:April 1996

Prepared by:
Pollution Prevention and Abatement Division, Environment Canada(Ontario Region)
Program Development Branch, Ontario Ministry of Environment and Energy
Pollution Prevention Office, Ontario Ministry of Environment and Energy

Edited by:
Pauline Macura Brown - Environment Canada Ontario Region
Nada Thornton - Ontario Ministry of the Environment and Energy

TD
420
.T54
1996
MOE

MOE
STANDARDS DEVELOPMENT BRANCH
LIBRARY

TD
420
.T54
1996

Tier I and II substance profiles per Canada - Ontario agreement respecting the Great Lakes basin.

78402

Copyright Provisions and Restrictions on Copying:

This Ontario Ministry of the Environment work is protected by Crown copyright (unless otherwise indicated), which is held by the Queen's Printer for Ontario. It may be reproduced for non-commercial purposes if credit is given and Crown copyright is acknowledged.

It may not be reproduced, in all or in part, part, for any commercial purpose except under a licence from the Queen's Printer for Ontario.

For information on reproducing Government of Ontario works, please contact Service Ontario Publications at copyright@ontario.ca

Ref. 72041

ENTERED SEP 11 2002 MOE

STANDARDS DEVELOPMENT BRANCH

LIBRARY

Introduction

The following is a compilation of information on non-pesticide substances listed on the Canada - Ontario Agreement respecting the Great Lakes Basin (1994) as requiring virtual elimination. These Tier I and II profiles will be updated on a continuous basis; an update will be made available annually in March of each year between 1996 and 2000. These profiles are intended for use by both the Ontario Ministry of Environment and Energy (MOEE) and Environment Canada (Ontario Region) for prioritizing their activities geared toward ensuring that the targets under COA respecting these substances are met. The information contained within the profiles will be used as the basis for initiating discussion and for soliciting commitments from stakeholders. In essence these profiles provide the baseline for each substance based on currently available information. It is recognized that new information will continually be provided that could alter the status of the substance.

For the 1996 update of the profiles emphasis has been placed on obtaining realistic source or release estimates. These data have been used to prioritize activities related to establishing partnerships. Tables 1 and 2 summarize the source data collected on each of the Tier I and II substances respectively. Tables 3 and 4 list the top 20 priority issues for each list based on the compiled data. The pie charts in figures 1 to 4 emphasize visually the importance of addressing sources related to the municipal, agricultural and transportation sectors as well as the industrial sources. If the 90% target is to be achieved, it is imperative that a comprehensive program be put in place that addresses all potential sources.

Using the priority lists an Action Plan for the MOEE and DOE staff has been established for 1996/97. By addressing the Tier I priorities first, the more pressing 90% reduction target is addressed. It is expected that some progress will also be achieved on the Tier II reductions as well because of the overlap in priorities. Pollution prevention will be used as the key tool for addressing the necessary reductions as this type of action best supports the eventual goal of virtual elimination. Pollution prevention will be encouraged by all (industry, municipal, individuals, governments, etc.). All toxic reductions will be reported in a Progress Report in September of every year for the duration of COA.

In terms of soliciting commitment Tier I substances pose a more pressing need. Under COA a target of 90% reduction by the year 2000 has been established by the parties for the Tier I substances. Tier II substances on the other hand, have been targeted for only substantial reductions by the year 2000. Substances on both lists should be virtually eliminated as soon as possible.

Please view the following profiles as working documents that are undergoing constant review. Please make the editors aware of any more relevant or recent data respecting

17734

TABLE 1 COA TIER I Substance Inventory (Estimated Releases and Sources) Revision Date: March 28,1996

Substance Issue	B(a)P	HCB	OCS	Dioxin & Furan NOTE: g/year	Alkyl Lead	Mercury	TOTAL	%
Incineration	**28**	**57.1**	**0**	**82.24**	**0**	**743**	**828**	**3.44**
Municipal Waste	10	7.3	0	2.51	0	374	391	
Medical waste	10	0.3	0	68.1	0	59	69	
Sewage Sludge	0	44.4	0	6.7	0	224	269	
Hazardous Industrial/ Commercial Waste	7	5.1	0	4.93	0	86	98	
Combustion	**191**	**1**	**0**	**7.73**	**0**	**832**	**1024**	**4.26**
Thermal Power Generation (Hydro)	158	0.3	0	7.73	0	528	687	
Other Industrial Coal Combustion	0	0	0	0	0	30	30	
Distillate Oil Combustion	10	0	0	0	0	94	104	
Residual Oil Combustion	8	0	0	0	0	180	188	
Wood Combustion	15	0.7	0	0	0	0	16	
Transportation	**1147**	**0**	**0**	**2.93**	**1000**	**0**	**2147**	**8.93**
Gasoline	296	0	0	0.37	0	0	296	
Diesel	851	0	0	2.56	0	0	851	
Aircraft	1	0	0	0	1000	0	1001	
Industrial	**12179**	**123.2**	**3.313**	**203.25**	**60.1**	**2160.5**	**14526**	**60.4**
Wood Preservation	5018		0	0	0	0	5018	
Iron & Steel	6028	1.4	3.29	21.4	0	362	6395	
Solvent Use - Drycleaning	0	6.2	0	0	0	0	6	
- Metal Degreasing	0	5.5	0	0	0	0	6	
- Other	0	0.2	0	0	0	0	0	
Mining & Smelting	0	0	0	0	0	837	837	
Secondary Copper production	0	1	0	61.3	0	0	1	
Chemical Manufacture	62	6.6	0.023	6.3	60	142	271	
Pulp & Paper (& Lime Mfg)	14	0	0	1.65	0	10	24	
Cement Mfg. (includes kilns)	0	102.3	0	112.6	0	300	402	
Ashphalt Plants	31	0	0	0	0	0	31	
Petroleum Refineries	750	0	0	0	0	0.5	751	
Metal Casting	101	0	0	0	0.1	5	106	
Nitroso & Styrene Rubber Manufacture	0	0	0	0	0	0	0	
Lighting Mfg.	0	0	0	0	0	60	60	
Municipal Treatment (Industry)	0	0	0	0	0	444	444	
Other	175	0	0	0	0	0	175	
Agricultural/ Non-residential	**1118**	**301**	**0**	**0**	**0**	**90**	**1509**	**6.28**
Opening Burning	1118	0	0	0	0	0	1118	
Pesticide Use	0	301	0	0	0	0	301	
Other Runoff (fungacide volatilization)	0	0	0	0	0	90	90	
Domestic / Residential Centres	**2247**	**0**	**0**	**34.2**	**0**	**1703**	**3950**	**16.4**
Open Burning	0	0	0	0	0	0	0	
Wood Stoves	2172	0	0	34.2	0	0	2172	
Municipal Water Treatment (Commercial, Residential	0	0	0	0	0	1671	1671	
CSOs (AOC)	0	0	0	0	0	6	6	
Runoff (AOC)	0	0	0	0	0	26	26	
Residential Heating	73	0	0	0	0	0	73	
Other (cigarettes)	1	0	0	0	0	0	1	
Waste Sites	**0**	**0.002**	**0**	**0**	**0**	**50**	50	**0.21**
TOTALS	**16910**	**482**	**3**	**330**	**1060**	**5579**	**24034**	
Percent of Total	**70**	**2**	**0**	**1**	**4**	**23**	**100**	

Table 2 COA TIER II Substance Inventory (Estimated Releases and Sources)

Revision Date: March 28,1996

Substance / Issue	Anthracene	Cadmium	1,4-dichlorobenzene	3,3'-dichlorobenzidine	dinitropyrene	4,4'-methylene bis(2-chloroaniline)	pentachlorophenol	tributyltin	PAH	TOTAL	% of Total
Incineration	**87**	**4100**	**0**	**0**	**0**	**0**	**0**	**0**	**606**	**4794**	**0.6**
Municipal Waste	32	1000							218	1250	
Medical waste	32	50							218	300	
Sewage Sludge	1	3000							9	3010	
Hazardous Industrial/ Commercial Waste	23	50							160	233	
Combustion	**603**	**10055**	**0**	**0**	**0**	**0**	**0**	**0**	**4178**	**14836**	**1.8**
Thermal Power Generation (Hydro)	500	1055							3465	5019	
Other Industrial Coal Combustion	0	9000							0	9000	
Distillate Oil Combustion	31								215	246	
Residual Oil Combustion	24								167	191	
Wood Combustion	48								331	379	
Transportation	**3620**	**2000**	**0**	**0**	**0**	**0**	**0**	**0**	**25095**	**30716**	**3.8**
Gasoline	933	1000							6470	8403	
Diesel	2685								18612	21296	
Marine		1000								1000	
Rail										0	
Aircraft	2								14	16	
Industrial	**24827**	**29264**	**182**	**160**	**0**	**602**	**814**	**0**	**275545**	**331395**	**41.1**
Wood Preservation	15831	0					809		109743	126383	
Iron & Steel	2316	3460							121748	127524	
Solvent Use - Drycleaning	0								0	0	
- Metal Degreasing	0								0	0	
- Other	0								0	0	
Mining & Smelting	0	18723							0	18723	
Secondary Copper production	0								0	0	
Chemical Manufacture	430	280	179	160		360			728	2137	
Pulp & Paper	45	139	3				5		312	504	
Ashphalt Plants	99								685	784	
Petroleum Refineries	5236	72							36297	41605	
Metal Casting	318	2857				2			2203	5380	
Nitroso & Styrene Rubber Manufacture	0					240			0	240	
Municipal Treatment (Industry)	0	1733							0	1733	
Metal Finishing (Sludge)		2000								2000	
Other	552								3829	4382	
Agricultural/ Non-residential	**3528**	**0**	**360**	**0**	**0**	**0**	**0**	**0**	**24455**	**28343**	**3.5**
Opening Burning	3528								24455	27983	
Pesticide Use	0								0	0	
Other Runoff	0		360						0	360	
Domestic / Residential Centres	**7089**	**0**	**340000**	**214**	**0**	**0**	**0**	**0**	**49140**	**396442**	**49.2**
Open Burning	0								0	0	
Wood Stoves	6854								47515	54369	
Municipal Water Treatment (Commercial, Residential	0								0	0	
CSOs (AOC)	0								0	0	
Runoff (AOC)	0								0	0	
Residential Heating	231								1599	1830	
Other (consummer products)	4		340000	214					25	340243	
Waste Sites										**0.00**	**0.0**
TOTALS	**39753.44**	**45419.74**	**340542**	**374**	**0**	**602**	**814**	**0**	**379019**	**806524**	**100.0**
Percent of Total	**4.93**	**5.63**	**42.22**	**0.05**	**0.00**	**0.07**	**0.10**	**0.00**	**46.99**		

Table 3

PRIORITY SOURCES TIER I SUBSTANCES

Priority	SOURCE	TIER I Release (kg/Year)	Tier I Substances	Tier II Sustances	Contribution to Tier	Cummulative Total Contribution	Cummulative %
1	Iron & Steel	6391	B(a)P,Hg,D/F	PAH,Cd	26.59	6391	26.59
2	Wood Presevation	5018	B(a)P	PCP,PAH	20.88	11409	47.47
3	Wood Stoves	2172	B(a)P	PAH	9.04	13581	56.51
4	STP Discharge (Non-Industrial Contrib)	1671	Hg		6.95	15252	63.46
5	Transportation (Diesel & Gasoline)	1147	B(a)P	PAH	4.77	16399	68.23
6	Open Burning	1118	B(a)P	PAH	4.65	17517	72.88
7	Aircraft (Aviation gasoline)	1001	TEL		4.16	18518	77.05
8	Mining & Smelting	837	B(a)P,Hg	Cd,PAH	3.48	19355	80.53
9	Petroleum Refinery	751	B(a)P	Anthracene, PAH	3.12	20106	83.65
10	Thermal Power Generation	687	B(a)P,Hg, D/F	PAH,Cd	2.86	20793	86.51
11	Incineration (Municipal Waste & Sewag	660	Hg,HCB,OCS,D/F	PAH,Cd	2.75	21453	89.26
12	STP Discharge (Industrial Contrib) & Ot	619	Hg, B(a)P	Cd	2.58	22072	91.83
113	Cement Mfg.	402	Hg,HCB,D/F		1.67	22474	93.51
14	Oil Combustion	292	B(a)P,Hg	PAH	1.21	22766	94.72
15	Chemical Manufacture	271	Hg, TEL,	pDCB,DCB,MOCA	1.13	23037	95.85
16	Metal Casting	106	B(A)P	PAH,Cd	0.44	23143	96.29
17	Hazardous Waste Incineration	98	Hg,D/F	PAH,Cd	0.41	23241	96.70
18	Fungicide Runoff	90	Hg		0.37	23331	97.07
19	Residential Heating	73	B(a)P	PAH	0.30	23404	97.38
20	Lighting Mfg	60	Hg		0.25	23464	97.63
21	Medical Waste Incineration	59	D/F,Hg	Cd	0.25	23523	97.87
	TOTAL	23523			97.87		

Date: March 28,1996

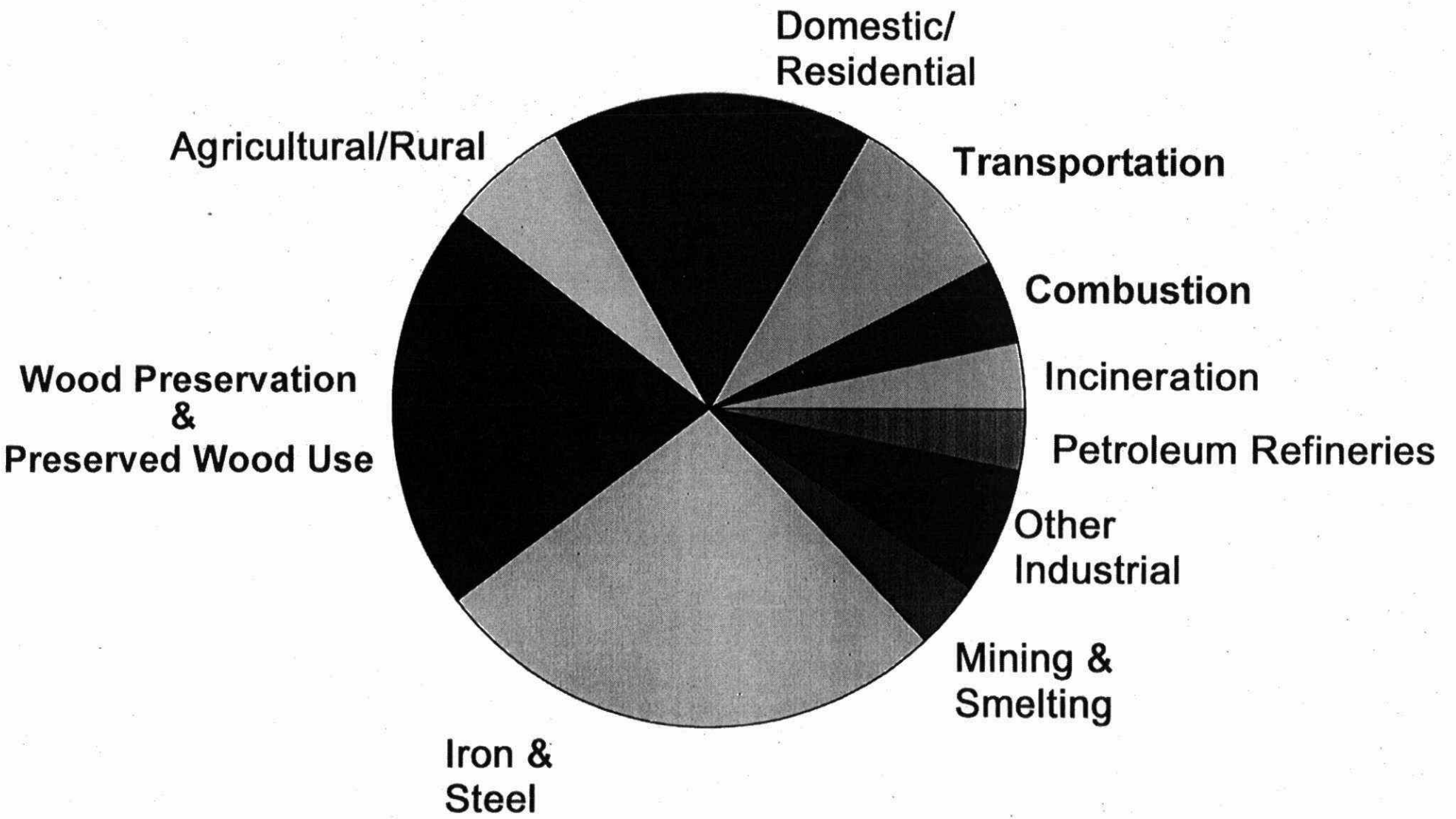
Table 4

PRIORITY SOURCES TIER II SUBSTANCES

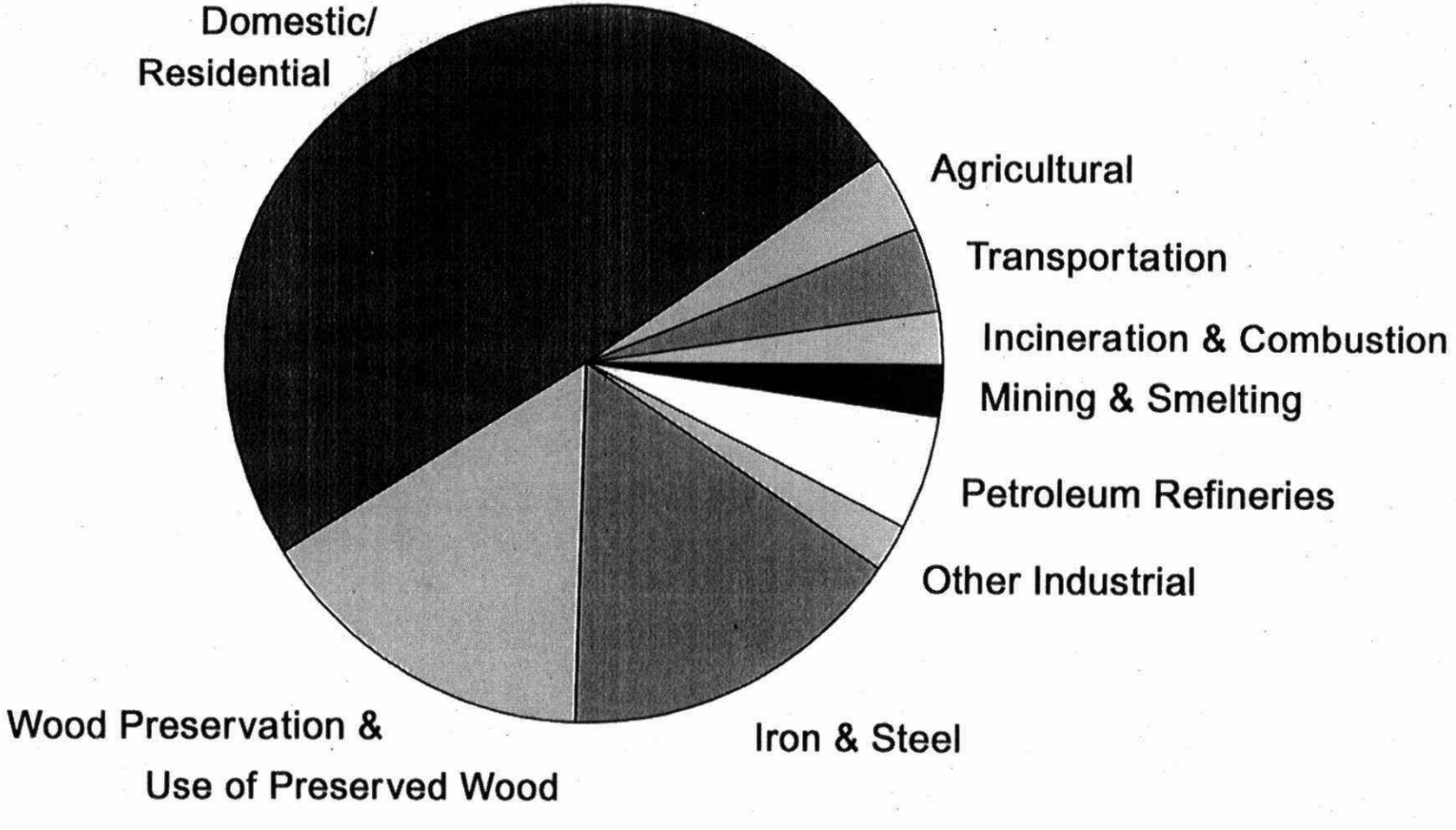
Priority	SOURCE	TIER II Release (kg/Year)	Tier I Substances	Tier II Sustances	Contribution to Tier II	Cummulative Tot Contribution	Cummulative %
1	p-DCB Deodorizer	340000		DCB	42.16	340000	42.16
2	Wood Preserevation	126383	B(a)P	PAH,PCP	15.67	466383	57.83
3	Iron & Steel	127524	B(a)P,Hg,D/F	Cd,PAH	15.81	593907	73.64
4	Wood Stoves	54369	B(a)P	PAH	6.74	648276	80.38
5	Petroleum Refinery	41605	B(a)P	Anthracene, PAH,Cd	5.16	689881	85.54
6	Transportation (Diesel & Gasoline)	29699	B(a)P	PAH	3.68	719580	89.22
7	Open Burning	27983	B(a)P	PAH	3.47	747563	92.69
8	Mining & Smelting	18723	B(a)P,Hg	Cd,PAH	2.32	766286	95.01
9	Coal Combustion (Other Industrial)	9000	B(a)P	PAH	1.12	775286	96.13
10	Metal Casting	5380	B(A)P	PAH,Cd	0.67	780666	96.79
11	Thermal Power Generation	5019	B(a)P,Hg, D/F	PAH,Cd	0.62	785685	97.42
12	Other Industry	4382		MOCA,DCBZ,PAH	0.54	790067	97.96
13	Incineration (Municipal Waste & Sewage Sludge)	4260	Hg,HCB,OCS,D/F	PAH,Cd	0.53	794327	98.49
14	Chemical Manufacture	2137	Hg, TEL,	pDCB,DCB,MOCA	0.26	796464	98.75
15	Metal Finishing Sludge	2000		Cd	0.25	798464	99.00
16	Residential Heating	1830		PAH	0.23	800294	99.23
17	STP Discharge (Industrial Contrib)	1733		Cd	0.21	802027	99.44
18	Marine	1000		Cd	0.12	803027	99.57
19	Asphalt plants	784		PAH	0.10	803811	99.66
20	Pulp & Paper	504		PAH,Cd	0.06	804315	99.73
	TOTAL	804315			99.73		

Date: March 28,1996

Issue/Sector Analysis Tier I Substances



Issue/Sector Analysis Tier II Substances



TIER I PROFILES

Alkyl Lead

Benzo(a) pyrene [see Polyaromatic Hydrocarbons]

Hexachlorobenzene

Mercury

Octachlorostyrene

Polychlorinated Dioxin and Furan

March 28,1996

PRIORITY SUBSTANCE PROFILE:

BENZO(A)PYRENE, ANTHRACENE & POLYCYCLIC AROMATIC HYDROCARBONS

This is one in a series of profile sheets on substances on the COA Tier I/II Target Substances Lists for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/ Plans to be developed for overall reduction of the substance(s) and,*
- *As a basis for initiating discussions with stakeholders.*

ENVIRONMENTAL PRIORITY LIST STATUS

- Benzo(a)pyrene (specifically) is on the Tier I list, Anthracene and PAHs (generally) are on the Tier II list;
- Benzo(a)pyrene, anthracene and many other PAHs are listed on the Ontario Ministry of Environment and Energy List of Bans and Phase-outs (1992) ;
- Many PAHs are listed on the ARET;
- Benzo(a) pyrene and anthracene are listed specifically on the ARET list;
- Anthracene and Naphthalene are on NPRI;
- PAHs as a group have been assessed under CEPA as TOXIC:
  - Harmful effect on the environment (Section 11a): YES
  - Danger to environment on which human life depends (Section 11b): NO
  - Danger to human life (Section 11c):YES

DESCRIPTION

PAHs are a group of chemicals that are formed during the incomplete buring of coal, oil and gas, garbage, or other organic substances.

The following PAHs are specifically included:

Benzo[a]pyrene	50-32-8
Anthracene	120-12-7

Other PAHs from ARET and NPRI include:

Benzo[a]anthracene	56-55-3	Dibenzo(a,i)pyrene	189-55-9
Benzo(a)fluorene	238-84-6	Dibenz(a,j)acridine	224-42-0
Benzo(b)fluorene	30777-19-6	Dimethylben(a)anthracene	57-97-6
Benzo(e)pyrene	192-97-2	Dimethylnaphthalene	28804-88-8
Benzo[b]fluoranthene	205-99-2	7H-dibenzo(c,g)carbazole	194-59-2
Benzo[j]fluoranthene	207-82-3	Fluoranthene	206-44-0
Benzo[k]fluoranthene	207-08-9	Indeno(1,2,3-c,d)pyrene	193-39-5
Benzo(g,h,i)perylene	191-24-2	Naphthalene	90-20-3
Chrysene	218-01-9	Perylene	198-55-0
Dibenz(a,h)anthracene	53-70-3	Phenanthrene	85-01-8
Dibenz(a,h)acridine	226-36-8	Pyrene	129-00-0

As pure chemicals, PAHs generally exist as colourless, white, or pale yellow-green solids. Most PAHs do not occur alone in the environment, rather they are found as mixtures of two or more PAHs. They can occur in the air either attached to dust particles, or in the soil or sediments as solids. They can also be found in substances such as crude oil, coal, coal tar pitch, creosote, road and roofing tar. Most PAHs do not dissolve easily in water, but some readily evaporate into the air. PAHS do not generally burn easily and will last in the environment for months to years.

PRODUCTION & USES

- PAHs are produced mainly through the combustion or pyrolysis of organic matter;
- PAH formation depends on type and quantity of the fuel being burned; temperature and duration of combustion; and availability of oxygen;
- Some PAHs are used commercially;
- The following PAHs were reported as produced or manufactured in Canada, based on voluntary reporting to the Domestic Substances List (DSL): naphthalene; anthracene; fluorene; acenaphthene; benzo[a]pyrene; chrysene; pyrene
- The major use of naphthalene in Canada (based on U.S. and Japanese data) is for the production of phthalic acid;
- PAHs are contained in gasoline, coal derivatives, and other petroleum products;
- A Number of PAHs are contained in Creosote (a wood preservative for railway ties)

SOURCES OF ENTRY INTO THE ENVIRONMENT

Natural Sources:

- Forest fires can be a significant source of PAHs; loadings from this source vary from year to year but has been estimated as high as 50% of annual loading

Man-made Sources:

- Release into atmosphere:
  Industrial processes:
  - Main source is aluminium smelting using Horizontal Stud Söderberg smelting process(there are no aluminum smelters in Ontario)
  - Other sources are: metallurgical processes; coke production; asphalt production; petroleum production;
- Combustion sources:
  - Residential heating; open air fires/agricultural burning; incineration; transportation; thermal power plants; industrial combustion; commercial and institutional heating; smoking;
- Release into water and soil:
  - Atmospheric deposition (main source of release to soil and sediments);
  - Spills of petroleum hydrocarbons;
  - Spills of creosote mixtures and leachate from creosoted treated wood products; accidental oil spills; precipitation and atmospheric deposition; industrial processes; municipal effluents; burial disposal of PAH wastes
  - Metallurgical sector (metal and coking plants) are main sources of release to water

See Table 1 for quantification of releases.

FATE, CONCENTRATION, TOXICITY

1. Persistence (half life):

   - In general, PAHs in aquatic systems adsorb to suspended matter or sediments where they persist and transform slowly; sediments are the final environmental sink for PAHs;
   - Atmosphere is the main medium of transport of PAHs;
   - Removal processes: Dry or wet deposition to soil or water or through chemical transformation; in the water column, sedimentation constitutes the primary removal mechanism.

   Distribution in the environment: Widely distributed

   - Air: Highest concentrations in ambient air in Canada were measured 1 km from aluminium smelters in Quebec; High concentrations were also measured in urban areas where heating by wood combustion is prevalent;
   - Tobacco smoke: PAHs were identified in cigarette, cigar, and pipe smoke;

Table 1
ESTIMATED ONTARIO ANTHROPOGENIC RELEASE/SOURCES (KG/YEAR)

Substance Issue	TOTAL PAH	Benzo(a)-pyrene	Anthracene	Other PAHS on ARET
Incineration				
Municipal Waste	534	10	32	218
Medical waste	534	10	32	218
Sewage Sludge	22	0	1	9
Hazardous Industrial/ Commercial Waste	391	7	23	160
Combustion				
Thermal Power Generation (Hydro)	8471	158	500	3465
Commercial Heating(oil, gas combustion)	525	10	31	215
Industrial Combustion (oil, gas, coal)	409	8	24	167
Wood Combustion (industrial)	810	15	48	331
Transportation				
Gasoline	15818	296	933	6470
Diesel	45505	851	2685	18612
Aircraft	35	1	2	14
Industrial				
Wood Preservation (Rail ties + pilings)	268320	5018	15831	109743
Iron & Steel	141948	6028	2316	121748
Chemical Manufacture	41000	62	430	728
Pulp & Paper	762	14	45	312
Asphalt Plants	1676	31	99	685
Petroleum Refineries	88746	750	5236	36297
Metal Casting	5386	101	318	2203
Other (spills)	9363	175	552	3829
Agricultural/ Non-residential				
Opening Burning	59792	1118	3528	24455
Domestic / Residential Centres				
Wood Stoves	116174	2172	6854	47515
Residential Heating	3910	73	231	1599
Other (cigarettes)	62	1	4	25
Waste Sites				
TOTALS	**810193**	**16910**	**39753**	**379019**

- Surface waters: Highest concentrations of PAHs in water in Canada were reported for water samples from ditches beside utility and railway lines;
- Groundwater: Few studies are available concerning the presence of PAHs in groundwater in Canada;
- Drinking water: Few data are available on the levels of PAHS in drinking water;
- Sediments: Highest concentrations were reported in sediments collected in or around industrialized harbours close to known sources of PAHs;
- Soils: Highest concentrations were found near former coking plants;
- Biota: High concentrations detected in marine organisms;
- Food: Foods obtained from more polluted areas will contain higher concentrations of PAHs than those from less polluted areas.

2. Bioaccumulation:

- PAHs accumulate in a variety of organisms; bioconcentration range from 4 to 7800 (low to very high);
- In addition to direct bioconcentration from water, uptake from food may also occur;
- However, biomagnification of PAHs up the aquatic food chain does not occur because PAHs are metabolised and thus eliminated by fish;
- Plants take in more PAHs from the atmosphere than from the soil.

3. Toxicity:

- Considerable data are available on toxicity of PAHs to aquatic organisms;
- Laboratory studies indicate: biota are adversely affected at various Canadian sites contaminated by PAHs; 5 PAHs have been identified as "probably carcinogenic" in the CEPA PSL assessment.

REGULATIONS TO CONTROL RELEASES/ SOURCES

Federal:

Industry reporting required under National Pollutant Release Inventory (NPRI) for naphthalene and anthracene only;
Pest Control Products Act (Wood Preservatives);
Transportation of Dangerous Goods Act (Spills during Transport);

Also: CCME Technical guidelines exist for safe design and operation of wood preservation facilities which use creosote-based pesticides.
CCME Guidelines for Fugitive Emissions from Chemical Plants and Petroleum Refineries.

Provincial:

Water: MISS Regulations for Petroleum, Iron & Steel, Metal Casting, Pulp & Paper, Organic Chemical and Inorganic Chemical Sectors;
Emergency Response Plan Program - Spill Reduction Program

RELATED GOVERNMENT PROGRAMS/INITIATIVES

- Strategic Options Process - Iron & Steel
  - Wood Preservation
- Wood Stove Manufacturers and Residential Associations
- Transportation Sections in both MOEE and DOE
- Pollution Prevention Project - MOU between CCPA and MOEE
- Remedial Action Plans

INDUSTRY INIATIVES

- NERM and implimentation of CCME guidelines for fugitive emissions, CCPA

POTENTIAL PARTNER PROGRAMS/INITIATIVES

Combustion Related Releases:	Oil/ Natural Gas/ Coal Distributors Community Awareness Programs Wood Stove/ Fireplace Manufactures Wood Processing Industry (Sawmills)
Transportation Related Releases:	Vehicle Operators (i.e. Public) Vehicle Manufacturers/ Sales/ Maintenance Fuel Distributors, Retailers and Manufacturers Community Awareness Programs/ Municipal Governments ENGOs Public Transit Commissions Trucking Companies

Industrial Process Related Releases:	Iron & Steel Producers (SOP) Petroleum/ Petrochemical Manufacturers Thermal Electric Power Generators (SOP) Pulp and Paper
Other:	Wood Preservation Facilities (SOP) Wood Preservative Users (SOP) Spill programs

PROGRESS TO DATE

See Table 2,3,&4

PROPOSED ACTIONS/ PRIORITIES FOR 1996/97

- Participate in SOPs for Iron & Steel, Wood Preservation, Thermal Power Generation
- Initiate partnerships for petroleum refining, wood burning stoves, vehicle emissions
- Verify Open Burning and Industrial Wood Burning Releases

REFERENCES

1. Putnam, David L. *Draft - Sources, Releases and Loadings - Preliminary Estimates for COA Substances.* A report prepared for Environment Canada - Ontario region under contract KE 409-4-0261. May 1995

2. Government of Canada. *Priority Substance List Assessment Report - Polycyclic Aromatic Hydrocarbons.* Canada Communications Group. © 1994.

3. Government of Canada. *Priority Substance List Assessment Report - Creosote Impregnated Waste Materials.* Canada Communication Group. ©1994.

4. 1993 NPRI *National Pollutant Release Inventory* Information for Naphthalene, Anthracene. Environment Canada.

5. 1993 *Accelerated Reduction/Elimination of Toxics* Program (ARET) inventory and 1994 ARET Update Inventory. ARET Secretariat. Hull, Quebec.

PROGRESS TO DATE (Commitments and Reductions)

Table 2: Polycyclic Aromatic Hydrocarbons (ARET list + naphthalene)

Facility	Location	Base Year	Releases(kg/year)			Comments
			Base Year	1993/94	2000	
Algoma Steel Inc.	Sault Ste. Marie		76190	76190	7620	ARET
E.B. Eddy	Espanola		127	127	12.7	ARET
E.B.Eddy	Ottawa/Hull		0.571	0.571	0.057	ARET
Natural Resources			1.101	1.101	1.101	ARET
Stelco - Hilton Works	Hamilton		221.4 2000	221.4 2000	132.8 2000	ARET NPRI, naphthalene
Stelco - Lake Erie Works	Nanicoke		2400	2400	2400	NPRI, naphthalene
Dofasco	Hamilton		50079	42410	42410	ARET
Domtar	Cornwall		832	83	83	ARET
Domtar	St. Catherines		0.2	0.2	0.2	ARET
Novacor Chemicals	Corunna	1993	39200			NPRI, naphthalene
Ruetegers-VfT	Hamilton	1993	100			NPRI, naphthalene
Imperial Oil Chemical Division	Sarnia	1993	1200			NPRI, naphthalene
PetroCanada	Oakville	1993	14300			NPRI, naphthalene
Imperial Oil Refinery	Nanicoke	1993	6900			NPRI, naphthalene
Imperial Oil Refinery	Sarnia	1993	7200			NPRI, naphthalene
Shell Canada Products Ltd.	Sarnia	1993	2600			NPRI, naphthalene
Sunoco	Sarnia	1993	1800			NPRI, naphthalene

Table 3: **Benzo(a)pyrene**

Facility	Location	Base Year	Releases(kg/year)			Comments
			Base Year	1993/94	2000	
Algoma Steel Inc.	Sault Ste. Marie		4100	4100	410	ARET
E.B. Eddy	Ottawa/ Hull		0.3	0.3	0.03	ARET
Stelco - Hilton Works	Hamilton		12.5	12.5	7.5	ARET

Table 4: Anthracene

Facility	Location	Base Year	Releases(kg/year)			Comments
			Base Year	1993/94	2000	
Dow	Sarnia		0.3	0	0	ARET
Imperial Oil Refinery	Nanicoke	1993	214	214	214	ARET, NPRI
Imperial Oil Refinery	Sarnia	1993	712	712	712	ARET, NPRI
Dofasco	Hamilton	1988	744	633	633	ARET, NPRI
Shell Canada Products	Sarnia	1988	1180	630	590	ARET, NPRI
Columbia Chemicals Ltd	Hamilton	1993	300			NPRI
PetroCanada	Oakville	1993	3120			NPRI
PetroCanada	Mississauga	1993	560	200	200	NPRI
Ruetgers Vft	Hamilton	1991	165	130	130	NPRI

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

ALKYL-LEAD

This is one in a series of profile on substances on the COA Tier/II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance(s) and*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

Alkyl-lead is on the following priority lists:

- Ontario Ministry of the Environment and Energy Bans and Phase-outs (1992) Secondary List - listed as lead and lead compounds
- NPRI: Listed as "Lead (and its compounds)". TEL also listed 1993 Summary as a Candidate substance list for addition to NPRI
- ARET B-1 list: toxic and bio-accumulative but not persist
- Assessment under CEPA: Tetraethyllead is listed as a toxic substance on Schedule I of CEPA.

DESCRIPTION

Alkylleads are organometallic compounds in which a carbon atom of one or more organic molecules is bound to a metal atom. Although some organolead compounds form naturally, the organolead compounds found in nature are man-made. Alkyl lead compounds (like tetraethyllead - TEL) are produced mainly as lead additives for gasoline.

	Chemical Formula	**CAS Number**
Tetraethyllead (TEL):	$Pb(C_2H_5)_4$	78-00-2
Triethyllead (TriEL):	$Pb(C_2H_5)_3Cl$	1067-14-7
Tetramethyllead (TML):	$Pb(CH_3)_4$	75-74-1

Physical/Chemical Properties[1]	TEL	TriEL	TML
Molecular Weight	323	329.7	267.2
State at Room Temperature	Liquid	Solid	Lliquid
Boiling Point	198° C	N.A.	108° C
Melting Point	-136° C	Decomposes at 120° C	-27° C
Liquid Density (g/cm^3)	1.65	N.A.	2.0
Water Solubility	0.2 mg/L	20.1 g/L	17.9 mg/L

PRODUCTION & USES

In the past most of the lead released to the atmosphere was from vehicles burning "leaded" gasoline. Alkyl-lead was used as antiknock additive in gasoline. It is estimated that in the past automotive emissions contributed 70-80% of the total lead input to the atmosphere. As of January 1990 the sale of leaded gasoline in Canada for the domestic car market has been eliminated.

Use of catalytic converters and the phase out of leaded gasoline has drastically reduced automotive emissions. However alkyl-lead is still being used as an additive in aviation gasoline, which is exempt from the Gasoline Regulations (SOR/90-247 under CEPA).

Other possible sources include alkyl-lead manufacturing and petroleum refinery/distribution sites which have been contaminated by alkyl-lead, leaded gasoline or other related materials.

Alkyl-lead is no longer manufactured in Canada. It used to be manufactured by two plants in Ontario, Ethyl Canada Inc (Sarnia) and Dupont Canada Inc. (Maitland). Dupont's Maitland site has been decommissioned, and monitored alkyl-lead residuals are non-detectable or very low close to non-detectable levels.

Ethyl Canada Inc. shut down its plant in 1994, but is still shipping tetraethyl lead in limited quantities from Houston to Edmonton and Montreal (3-4 tank trucks a year).

SOURCES OF ENTRY INTO THE ONTARIO ENVIRONMENT

TABLE 1

POTENTIAL SOURCES	Alkyl lead Releases (kg/yr)		
	Air	Water	Total
Transportation-Unleaded Gasoline Vehicles	negligible	negligible	negligible
Transportation-Antique Cars	no info.	no info.	-
Transportation-Aviation	1,000	no info.	1,000
Industrial-Org. Chemicals	10	50	60
Industrial-Metal Casting	-	0.1	0.1
Industrial-Contaminated Sites	no info.	no info.	-
Agricultural-Farm Machines	negligible	negligible	negligible
TOTAL	**1,010**	**50.1**	**1,060.1**

FATE, CONCENTRATION, TOXICITY

1. *Bioaccumulation:* The accumulation of alkyllead compounds in fresh water organisms is dependent on their lipophilic nature - only TEL and marginally TML are sufficiently lipophilic to accumulate in the fatty tissues of aquatic organisms. Alkyllead has been found in fish from St. Clair river and St. Lawrence river. Alkylleads in these locations came from two chemical plants which manufactured alkyllead: Dupont at Maitland (St. Lawrence) and Ethyl Canada at Corunna (ST. Clair). Total lead levels in the edible parts of fish were higher than 1 ppm near Maitland (50-70% of total lead came from alkyllead).

2. *Persistence (half life)*: Tetraalkylleads break down rapidly in water especially in the presence of light. Breakdown of TEL occurs even in the vapour state before washdown in rain. TEL has two day half-life in fresh water. Intermediate breakdown products, tri- and dialkylleads, are persistent in the aquatic environment for several months. The final breakdown product is inorganic lead.

3. *Toxicity*: The toxicity of the alkylleads has not been well studied because of technical problems encountered in handling these often volatile and unstable compounds. The alkylleads are much more toxic than inorganic lead because of their lipophilic nature and ability to permeate biological membranes.

Single acute doses of tetraethyl-lead are at least 20 times more toxic than equivalent doses of inorganic forms of lead. At levels of 5 µg/L tetraethyl lead is lethal to trout.

The presence of alkyl-lead in soil, especially in urban areas, has been associated with adverse effects on children.

4. *Concentration in the environment:* Levels of alkyl-lead in the environment have been decreasing since 1981 and it will continue to decrease as it is phased out of gasoline.

ENVIRONMENTAL STANDARDS (regulations/guidelines)

Ontario: Ontario Water Quality Objective: 0.0007 µg/L

REGULATIONS TO CONTROL RELEASES/SOURCES

Federal:

Industry reporting under National Pollution Prevention Release Inventory (NPRI), Gasoline Regulations under CEPA

OTHER GOVERNMENT PROGRAMS/INITIATIVES

None Identified

INDUSTRY INITIATIVES

Closure of both manufacturing plants, Ethyl Corp. in Sarnia and Dupont Canada Inc. in Maitland, has resulted in noticeable reductions of alkyllead emissions.

The CCPA requires reporting of lead and its compounds to the NERM program.

POTENTIAL PARTNERS/ISSUES/PROPOSED ACTIONS

(see attached)

PROGRESS TO DATE

Since 1990 Ethyl reduced alkyl lead emissions by 6,200 kg/yr.

Releases from vehicle emissions in Toronto alone is estimated to have been reduced from 72,000 kg/year to essentially 0 kg/year from 1988 to 1989.

PROPOSED ACTIONS/ PRIORITIES FOR 1996/97

Verify aviation fuel still contains alkyl lead additives and persue reductions as appropriate.

REFERENCES

1. Scientific Criteria Document of Provincial Water Quality Guidelines for Alkylleads, MOEE, July 1994.

2. putnam, David L. *Draft - Sources, Releases and Loadings - Preliminary Estimates for COA Substances*. A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261, May 1995.

POTENTIAL PARTNERS/ISSUES/PROPOSED ACTIONS

TABLE 2
ALKYLLEAD RELEASES, POTENTIAL PARTNERS AND ACTIONS

POTENTIAL SOURCE	ESTIMATED RELEASE (Kg/yr)	COMMITTED REDUCTIONS	POSSIBLE PARTNERSHIPS	ACTIONS FOR 1996
Transportation - Aviation	1000	None	- Canadian Petroleum Products Institute (CPPI) - Shell Canada - Petro Canada	Find out: - Who makes aviation fuel? - Why do they need to use leaded fuel? - Are there any plans to replace the aircraft engine design? - Are there any emission data? - Can TEL be reduced? - Any data of soil contamination from past spills.
Industrial - Organic Chemicals	60	98% by 1996	Ethyl Canada - Corunna Dupont - Maitland	- Confirm the info - emission data? - Clean-up programs in place? - Check how imported alkyllead is handled?

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

HEXACHLOROBENZENE

This is one in a series of profiles on substances on the COA tier I/II Target Substance lists for reduction. This profile is intended to:

- *Summarize existing information on hexachlorobenzene to enable an Action Plan/Plans to be developed for the overall reduction of the substance; and,*
- *As a basis for initiating discussions with stakeholders.*

ENVIRONMENTAL PRIORITY LIST STATUS

- Hexachlorobenzene (HCB) is on the Tier I list of Toxic substances under COA and has therefore been designated for **virtual elimination**

- Assessment under CEPA: Toxic
  Harmful effect on the environment (Section 11a): Yes
  Danger to environment on which human life depends (Section 11b): No
  Danger to human life (Section 11c): Yes
- HCB was one of the International Joint Commissions 11 Substances - It has been identified in the Lake Superior LaMP as a Critical Pollutant
- HCB is included in the ARET program as a A-1 compound (i.e. toxic, bioaccumulative, persistent)
  HCB is on the Ontario Ministry of Environment and Energy's List of Candidate Substances for Bans, Phase-outs

DESCRIPTION

Chemical Name:	Hexachlorobenzene
CAS NO.:	118-74-1
Chemical Formula:	C_6Cl_6
Molecular Weight:	284.79
Vapour Pressure:	0.0023 Pa @ 25°C
Octanol/Water Partition Coefficient:	log k_{ow}=5.5

Hexachlorobenzene is a white crystalline solid at ambient temperatures. It is virtually insoluble in water (0.005 mg/L @ 25°C).

PRODUCTION & USES

- HCB does not occur naturally;
- HCB has not been commercially produced in Canada or the U.S.A. since at least 1980s but it has been imported into Canada from the U.S.A. and France in 1990 (10 tonnes);
- HCB is a by-product of several manufacturing processes (e.g., chlorinated solvent manufacture, chlorinated pesticide manufacture and chlor-alkali and sodium chlorate maufacture rubber tire manufacture);
- HCB is used in the manufacture of pyrotecnics and tracer bullets;
- HCB is a fluxing agent in the manufacture of aluminium;
- Peptizing agent in the production of nitroso and styrene rubber for electrodes;
- HCB has been used in the past as a wood preserving agent; and
- HCB was a registered as a fungacide under the Pest Control Products Act; discontinued in 1972

SOURCES OF ENTRY INTO ONTARIO ENVIRONMENT

- Manufacture and use of chlorinated solvents (HCB present as a by-product)
- Manufacture and application of pesticides (HCB is an impurity)
- Application of Wood Preservatives (PCP) both on industrial and domestic scale
- Incineration of wastes containing (Kepone, mirex, chlorobenzene, PCBs, PCP, PVC,chlorinated solvents);
- Leaching from waste landfills historically used for HCB containing wastes;
- From industrial sources via municipal wastewater treatment plant effluents;
- Long Range Transport from U.S. and Western Canada

(see Table 1 for estimated release quantities)

FATE, CONCENTRATION, TOXICITY

1. Persistent (half life): persistent
   Distribution in the environment: WIDE; present in all media air, water, soil, sediment, soil, biota

2. Bioaccumulation:
   Removal process: Mainly volatilization

3. Toxicity:

   - Acute toxicity in animals is low
   - Short term exposure: primarily toxic to kidney, neurology; high doses: death, skin lesions, behavioural change, neurologic, reduced body weight

Quantification Table (Current Estimates)

Source	Releases (Kg/year)				Comments
	Air	Water	Waste	Total	
Solvent Use					
Drycleaning	5.6	NA[e]	0.6	6.2[d]	
Metal Cleaning/ Degreasing	5.5	NA		5.5[d]	
CFC Production					
HCFC Production		NA		NA	It is suspected that HCFC may result in HCB release
Other Solvent Use				0.2[d]	
Coke & Steel Mfg	1.4			1.4	
Secondary Copper Smelter	1.0			1.0	
Pentachlorophenol Use					
Industrial					
Domestic					
Wood in Service					
Pesticide Use	301			301	
Solvent Manufacturer					
Carbon Tetrachloride	6.2	0.4		6.6	@ Cornwall Chem.
Trichloroethylene	NA	NA		NA	No longer mfg. in Ont.[c]
Perchloroethylene	NA	NA		NA	No longer mfg. in Ont.[c]
Manufacture of Nitroso & Styrene Rubber		NA			
Chlor-Alkali and Sodium Chlorate Manufacture	0	0	0	0	Ontario manufacturers no longer use graphite electrodes
Manufacture of Pestcide[b]	0	0	0	0	None listed in Scotts- OK?
Other Industrial[f]					
Incineration					
Industrial Waste	5.1[a]			5.1[a]	Laidlaw, Sarnia
Municipal Waste	7.3[a]			7.3[a]	
Sewage Sludge	44.4[a]			44.4[a]	
Cement Kilns	102.3[a]			102.3[a]	St. Lawrence, Mississauga burns HCB
Medical Waste	0.3[a]			0.3[a]	containing fuel?
Wood Combustion (Ontario)	0.7[a]			0.7[a]	
Coal Combustion (Ontario)	0.3[a]			0.3[a]	
Waste Site Leaching					
HCB Wastes	NA	0.002		0.002	
Wood Preservation Sites					
TOTALS				**482**	

See notes next page

NOTES:

a Using metodology as outlined in reference 3.

b Clorinated Pesticides suspected of HCB impurity include: chloroanthil (0.05% HCB); dimethyltetrachloroterephthalate(0.3% HCB); picoram(0.02% HCB); atrazine; pentachloronitrobenzene; dacthol; simazine

c Dow Chemical in Sarnia ceased manufacture of chlorinated solvents in 1992.

d HCB releases from these sources have been estimated from perchloroethylene and trichloroethylene imports for Canada. It assumes an upper maximum concentration of 5 mg/L HCB in the solvents and that 100% of the solvent is lost to the environment. The drycleaning estimates compare well with estimates of drycleaning loses taking into account the age and type of equipment used.

e Water effluents from solvent and pentachlorophenol users (except where noted) will be accounted for in the Municipal effluent and municipal incineration estimates.

f Other potential sources of HCB paint manufacturing, pulp and paper mills, pyrotechnic manufacture, soap manufacture.

- Long term exposure: at low doses shows reproductive and developmental toxicity; a carcinogen in humans

Concentration in the Environment (1980-1992)

Air: Downtown Windsor & Walpole Island(1988-89): 0.15ng/m^3 ref.Detroit Incinerator Monitoring Program

Similar concentrations have been reported at other central and southern Ontarion sites(1985-89)

Drinking Water: HCB has been detected infrequently and at low concentrations in drinking water supplies. In 1980 HCB was found in water samples collected from three Lake Ontario Municipalities at a mean concentration of).1 ng/L.

Surface Water: Of 189 samples collected from the connecting channels and the Great Lakes between 1980-1986 the concentration in only one was found to exceed 1.0 ng/L at Hamilton Harbour (4.0 ng/L).

In 1986:
0.026 ng/L Lake Superior
0.033 ng/L Lake Huron (also in 1980)
0.041 ng/L Georgian Bay
0.078 ng/L Lake Erie
0.063 ng/L Lake Ontario (also in 1980)

In the connecting channels, HCB has been found more often to exceed 1.0 ng/L especially near point sources;

St. Clair River near Dow Chemical outfall:	87 ng/L (1985)
	75 ng/L (1986)
Niagara River near Niagara on the Lake:	1.1 ng/L (mean 1981-83)
	29 ng/L (max 1981-1983)
	0.1 ng/L (mean 1988/89)
	0.2 ng/L (max 1988/89)

REGULATIONS TO CONTROL RELEASES/ SOURCES

- HCB is directly regulated under the MISA Regulations for organic and inorganic chemical sectors effluent discharges
- HCB is indirectly regulated under the provincial solvent regulations - ODS consumption and use
- HCB is indirectly regulated under CEPA regulation limiting CFC manufacture and phase out by 1996
- HCB is indirectly regulated under the CEPA regulation limiting HCFC manufacture and phase out by 2020

RELATED GOVERNMENT PROGRAMS/ INITIATIVES

- Strategic Option Process for : Hexachlorobenzene
- The solvent issue is being indirectly addressed by the following SOPs:
  Drycleaning
  Degreasing
- The solvent issue is also being addressed by a number of pollution prevention agreements with industrial sectors.

INDUSTRY INITIATIVES

- HCB is reported under NERM (CCPA, 1993)

POTENTIAL PARTNERS/ ISSUES

HCB SOP
Drycleaning SOP and P2 MOU
Degreasing MOU and MVMA, MFI, APMA, Printing & Graphoics P2 MOUs
Pesticides Review Committee
Iron & Steel SOP
Cement Kiln Operators
Waste Incinerators (Municipal, Sewage Sludge, Medical, Hazardous)

REPORTED PROGRESS TO DATE (Commitments and Reductions)

COMPANY	BASE YEAR	HCB RELEASES (kg/year)			COMMENTS
		BASE YEAR	1993/94	2000	
Abitibi-Price - Fort William	1988	8.68×10^{-4}	8.68×10^{-4}		ARET
Dofasco Inc. - Hamilton	1988	0.7	0.4		ARET
Dow Chemical Canada Inc. - Sarnia	1988	1.4	0		ARET
Natural Resources Canada - Ontario	1988	1.01×10^{-2}	1.01×10^{-2}		ARET
Solvent Use - Perchloroethylene - Trichloroethylene	1990	11.2 2.6	8.4 3.5		Estimate Based on Perc Imports
TOTAL	5 Sources	23.01	18.52		**19.5% Reduction**

PROPOSED ACTIONS/PRIORITIES FOR 1996/97

Verify sources and record reductions where possible since 1988. Refer pesticide issue to the pesiticide review committee. Confirm concentration of HCB in chlorinated solvents.

REFERENCE LIST

1. Government of Canada. *Priority Substance List Assessment Report Hexachlorobenzene.* Canada Communications Group © 1993.

2. Putnam, David L. *Draft- Sources, Releases and Loadings - Preliminary Estimates for COA Substances.* A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261. May 1995.

3. Alves, H.H.D., and M. Chevalier. 1980. *L'hexaclorobenzene dans l'environnment quebecois: Production, utilisation et presence.* EPS-3 QR-80-1

4. Environment Canada 1991. *List of Incinerator Facilities in Canada*. RRETC

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

MERCURY

This is one in a series of profiles on substances on the COA tier I/II Target Substance lists for reduction. This profile is intended to:

- *Summarize existing information on mercury to enable an Action Plan/Plans to be developed for the overall reduction of the substance; and,*
- *As a basis for initiating discussions with stakeholders.*

ENVIRONMENTAL PRIORITY LIST STATUS

- Mercury is on the Tier I list of Toxic substances under COA and has therefore been designated for **virtual elimination**
- Assessment under CEPA: N/A
  Mercury is listed on Schedule I of CEPA as a toxic substance.
- Mercury was one of the International Joint Commissions 11 Substances - It has been identified in the Lake Superior LaMP as a Critical Pollutant
- Mercury is included in the ARET program. Methyl mercury is on the A-1 compound (i.e. toxic, bioaccumulative, persistent) list while mercury and its compounds are on the B-2 list (persistent and toxic)
- Mercury is on the Ontario Ministry of Environment and Energy's List of Candidate Substances for Bans, Phase-outs

DESCRIPTION

Chemical Name:	Mercury
CAS NO.:	7439-97-6
Chemical Formula:	Hg
Molecular Weight:	200.59

Mercury is a silver-white, heavy mobile liquid metal at room temperature. It form a ductile malleable mass which may be cut by a knife.

Vapour Pressure: 0.002 mm Hg @ 25°C
Solubility: o.28 Umoles/L water @ 25C

PRODUCTION & USES

- Mercury is not mined in Canada, but is imported from the US and Germany.
- It is used in the manufacture of products such as: batteries, fluorescent lamps, electrical switches, thermometers, etc.
- Chlor-alkali plants using mercury cells are a major source of mercury released in the U.S. In Ontario chlor-alkali manufacturing facilities no longer use mercury cells.

SOURCES OF ENTRY INTO ONTARIO ENVIRONMENT

Mercury is released into the environment naturally (volcanic activity, weathering of rock, volatilization from soils and oceans, forest fires) and deliberately (anthropogenic sources) through the use and manufacture of mercury containing products. It is estimated that two-thirds of the mercury in the environment are from anthropogenic activity.

(See Table 1 on page 3.)

FATE, CONCENTRATION, TOXICITY

1. Persistent (half life): persistent

Two characteristics of mercury make it somewhat unique as a environmental contaminant, namely; its volatility and its biotransformation.

2. Bioaccumulation

Mercury biaccumulates and concentrates in the food chain. Concentrations for freshwater fish 63,000 and for salt water fish of 10,000 times have been found.

3. Toxicity:

- Neurotoxin
- Exposure to elevated concentrations of mercury vapour: damage to kidney, nervous system; birth defects (likely in enclosed environments where mercury is handled

TABLE 1

Emission Source	ANTHROPOGENIC RELEASES of MERCURY (kg/Year)		
	AIR	WATER	TOTAL
Incineration			
Municipal Waste	374		374
Medical Waste	59		59
Sewage Sludge	224		224
Hazardous Industrial/Commercial Waste	86		86
Combustion			
Thermal Power Generation	426		426
Other Coal Combustion	30		30
Oil Combustion	274		274
Industrial			
Iron & Steel (Coke Manufacturing)	306	56	362
Metal Mining	284	553	837
Cement Production	300		300
Pulp and Paper (& Lime Manufacturing)	-	10	10
Carbon Black Manufacturing	-		-
Inorganic Chemical Manufacturing		98	98
Organic Chemical Manufacturing		43	43
Metal Casting		5	5
Petroleum Refineries		0.5	0.5
Lighting Manufacturing	60		60
Others (to Sewer)		444	444
Domestic/ Residential/ Commercial			
Municipal Treatment Plants(non-industrial related)		1671	1671
Runoff (AOC)		26	26
CSOs (AOC)		6	6
Agricultural/ Non-residential			
Fungicide Volatilization	90		90
Waste and Contaminated Sites	50		50
TOTAL	2665	2907	5572

with inadequate ventilation)

- Long term exposure to low levels of mercury can produce effects such as weakness, fatigue, loss of appetite, insomnia, psychological changes leading to nervous system damage. Prenatal exposure causes inhibited fetal brain growth resulting in reduced cognitive and motor ability.

- Exposure to humans and wildlife is almost exclusively from consumption of methyl mercury in fish.

Atmosphere Mercury in the environment is deposited and revolatilized many times, with a residence time in the atmosphere of at least a few days.
Fifty percent of the mercury in the environment is mercury vapour with a sizeable portion of the remainder being Hg(II) and methyl mercury. In the volatile phase it can be transported hundreds of kilometres. Mercury's volatility accounts for high atmospheric concentrations near areas containing high soil levels. The normal atmospheric concentration of Hg is approximately 5 ug/m^3.

Aquatic In aquatic systems , mercury tends to bind to dissolved matter of fine particulate. Mercury can be desorbed into the water column, transported by water (probably bound or chelated to fine particles or dissolved substances) and redeposited on the bed sediment.

Primary importance is fish concentrations.

REGULATIONS TO CONTROL RELEASES/SOURCES

Chlor-alkali mercury release regulations under the Canadian Environmental Protection Act
Chlor-Alkali Mercury Liquid Effluent Regulations under the Fisheries Act
Point of Impingement Regulation under Ontario EPA
Ontario Waste Regulation

OTHER RELATED GOVERNMENT PROGRAMS/ INITIATIVES

MISA Municipal Regulation Development could address sewer sources from industry.
MISA Regulations for Inorganic and Organic Chemical Sectors.
Iron & Steel SOP.

INDUSTRY INITIATIVES

None identified.

POTENTIAL PARTNERS/ ISSUES

Ontario Mining Association
Ontario Hydro
Canadian Portland Cement Association
Iron & Steel SOP & Canadian Environmental Steel Association
Electric Power Generation SOP
MOEE Incineration group

PROGRESS TO DATE(Reductions and Commitments)

TABLE 2

COMPANY	LOCATION	Releases (kg/year)			COMMENTS
		BASE YEAR	1993/1994	2000	
Abitibi-Price	Fort William	12.5	12.5		ARET
Dofasco Inc.	Hamilton	11.0	4.0		ARET
Dow Chemical	Sarnia	0	1		ARET
E.B. Eddy	Espanola	0.4	0.4		ARET
E.B.Eddy	Ottawa	0.2	0.2		ARET
Falconbridge	Kidd Creek	20	20		ARET
General Electric Canada Ltd.	Peterborough	60	60		ARET
Natural Resources Canada		1.0115	1.0115		ARET
Ontario Hydro		0.5	0.5		ARET
Stelco Inc.	Lake Erie Works	18	18		ARET
ICI Forest	Cornwall	65	0.34	0.16	NPRI & NERM
Novacor Chemicals	Corunna	3	3		NPRI
TOTAL	**12 Facilities**	**191.6**	**185.6**		**5% Rreduction**

No mercury reductions have been reported to the P4 program to date.

PROPOSED ACTIONS/PRIORITIES

The priority is to ensure steps are taken towards reduction or continued reductions in the following sectors:

STP Discharges (non-industrial contribution)
Metal Mining
STP Discharges (industrial contribution)
Thermal Power Generation
Incineration (Municipal, Sewage Sludge, Medical, Hazardous Wastes)
Iron & Steel
Cement Mfg.

Confirmation of the continued use of mercury in fungacides. Verify oil combustion is a source of mercury and to what extent.

REFERENCES

1. Putnam, David L. *Draft- Sources, Releases and Loadings - Preliminary Estimates for COA Substances.* A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261. May 1995.

2. Sang, Susan and Lourie, Bruce. *Mercury in Ontario: An Inventory of Sources, Uses and Releases.* Pollution Probe's Mercury Elimination and Challenge Project. September 1995.

3. Alves, H.H.D., and M. Chevalier. 1980. *L'hexaclorobenzene dans l'environnment quebecois: Production, utilisation et presence.* EPS-3 QR-80-1

4. Environment Canada 1991. *List of Incinerator Facilities in Canada*. RRETC

March 28,1996

PRIORITY SUBSTANCE PROFILE:

OCTACHLOROSTYRENE

This is one of a series of profiles on substances on the COA Tier I/II Target Substance lists for reduction. This profile is intended to

- *Summarize existing information on octachlorostyrene to enable an Action Plan/Plans to be developed for the overall reduction of the substance; and,*
- *As a basis for initiating discussions with stakeholders.*

ENVIRONMENTAL PRIORITY LIST STATUS

- Octachlorostyrene (OCS) is on the Tier I list of Toxic substances under COA and has therefore been targeted for virtual elimination.
- OCS was not assessed for toxicity under CEPA.
- OCS was one of the International Joint Commissions 11 Critical Pollutants.
- OCS is included in the ARET program as an A-1 compound (i.e. toxic, bioaccumulative and persistent.
- OCS is not on the Ontario Ministry of Environment and Energy Bans and Phase Outs List.

DESCRIPTION

Chemical Name(s):	Octachlorostyrene, Pentachloro(trichloroethenyl)-benzene Trichlorovinylpentachlorobenzene
CAS No. :	29082-74-4
Chemical Formula:	C_8Cl_{18}
Molecular Weight:	379.68
Henry's Law Constant:	1.3 X 10^{-4} atm m^3/mole @ 25^0C
Octanol/Water Partition Coefficient:	log K_{ow}= 6.29

PRODUCTION & USES

Octachlorostyrene is not produced commercially for any application. Octachlorostyrene

is mainly an accidental by-product of high temperature industrial processes involving chlorine. Octachlorostyrene has been identified in effluents from chlorine gas, magnesium, niobium and tantalum production and in the smelting of aluminum. It has also been identified in landfill leachates, fly ash from waste incinerators and in sewage sludge from municipal treatment facilities.

SOURCES OF ENTRY INTO THE ONTARIO ENVIRONMENT

It is predicted that OCS will be discharged through similar operations as HCB although data is unavailable.

SOURCE	Releases (kg/Year)		TOTAL
	AIR	WATER	
Incineration	*****		******
Industrial			
Cement Kilns	*****		*****
Chemical Mfg		0.023	0.023
Iron & Steel		3.29	3.29

***** Potential Source - No Estimates Available

FATE, CONCENTRATION, TOXICITY

Octachlorostyrene is persistent, bioaccumulative and toxic.

Atmosphere: If octachlorostyrene is released to the environment , reactions with photochemically produced hydroxyl radicals may be important. The compound has an atmospheric half-life of approximately 17 days ([OH.}=5 x $10^5/cm^3$).

Aquatic: Sufficient data is not available to predict the importance of biodegradation and chemical degradation in aquatic systems however, limited evidence suggest octachlorostyrene may undergo direct photolysis. Bioconcentration of octachlorostyrene from the water column to organic matter in sediments and suspended solids has been indicated. The Henry's Law constant suggests that volatilization from the water column maybe important.

Surface Water: August-October 1985: in the St. Clair River Octachlorostyrene was found

in 21 of 52 samples from the St. Clair River at a concentration of 0.011 to 0.085 ng/L.

Sediments: Bottom sediments of Lake St. Clair contained octachlorostyrene at a concentration ranging from undetected to 79.5 ug/kg dry weight with an average of 14.8 ug/kg for 21 samples. The concentration of octachlorostyrene ranged from 2.5 to 4.1 ng/g dry weight for 6 sediment samples taken near Niagara Falls in Lake Ontario.

Fish/Seafood: The average concentration of 10 Rainbow Trout from Lake Ontario was 2.6 ng/g (1985). Fresh water claims in the St. Clair River contained octachlorostyrene ranging from 2.9 to 192.7 ug/kg dry weight with an average 35.9 ug/kg for 6 samples.

REGULATIONS TO CONTROL RELEASES/ SOURCES

MISA inorganic and organic regulations have an OCS limit.
No other relevant regulations have been identified.

RELATED GOVERNMENT PROGRAMS/ INITIATIVES

None identified.

INDUSTRY INITIATIVES

OCS is reported under NERM (CCPA,1993). No company reported at 1 kg or more.

PROGRESS TO DATE (COMMITMENTS and REDUCTIONS)

Facility	Location	Baseline	1993/1994	2000	Comments
Dow Chemical	Sarnia	0.7	0	0	ARET
Total	**1 Facility**	**0.7**	**0**	**0**	**100% Reduction**

POTENTIAL PARTNERS/ISSUES

See Priority Substance Profile: Hexachlorobenzene

PROPOSED ACTIONS/PRIORITIES FOR 1996

Verify source of octachlorostyrene to the environment still exists and pursue reductions as appropriate. To be done in conjunction with HCB initiatives dealing with incineration sources.

REFERENCES

1. Putnam, David L. *Draft - Sources, Releases and Loadings - Preliminary Estimates for COA Substances.* A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261. May 1995.

2. Hazardous Substance Data Bank. 1987-1996 Micromedex Inc. Vol. 27, Expires 1/31/96

3. RTECS Data Base.

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

POLYCHLORINATED DIBENZO-P-DIOXINS (PCDDs) & POLYCHLORINATED DIBENZOFURANS (PCDFs)

This is one in a series of profile on substances on the COA Tier/II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance(s) and*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- PCDDs and PCDFs are on the Ontario Ministry of the Environment and energy list of Bans and Phase-outs (1992).

- PCDDs and PCDFs are on the ARET. A-1 list of ARET contains specifically 2,3,7,8 TCDD and 2,3,7,8 TCDF.

- Assessment under CEPA: TOXIC
  Harmful effect on the environment (Section 11a): YES
  Danger to environment on which human life depends (Section 11b):NO
  Danger to human health (Section 11c): YES

- A federal task force has been set up to consider additional regulatory limits for the substance.

- LAMP (Lake-wide Management Plans) have a zero discharge target for Lake Superior.

DESCRIPTION

Alternate names: PCDDs and PCDFs or CDDs and CDFs

Physical properties:

Pure dioxins and furans are white, crystalline solids at room temperature and atmospheric pressure. They are very stable in the environment.

Chemical properties:

PCDDs and PCDFs are a group of 210 substances, similar in their molecular structure, but they differ in the number and arrangement of their chlorine atoms.

Number of Chlorines	Number of Compounds	
	Dioxins	Furans
1	2	4
2	10	16
3	14	28
4	22	38
5	14	28
6	10	16
7	2	4
8	1	1
Totals	**75**	**135**

Because they have similar biological effects, the individual substances, or congeners, are grouped according to the number of chlorine atoms. Only 17 of 210 congeners, which have chlorine atoms in a 2,3,7,8 position, exhibit toxic properties. Two of them, 2,3,7,8 TCDD and 2,3,7,8 TCDF are listed as Tier 1 substances and are considered extremely toxic to humans.

PRODUCTION & USES

Formation of PCDDs and PCDFs results when chlorine and organic matter are brought together in a thermally or chemically reactive environment.

PCDDs and PCDFs are not produced intentionally. However, they frequently occur as by-products in the manufacture of chlorinated organic substances. They are also produced when such substances are burned or when chlorine is present in any combustion process. They can also occur when chlorine or chlorine products are used for bleaching, as in the pulp and paper industry.

PCDDs and PCDFs are usually formed in the following processes:

- Municipal and medical waste incinerators
- Chlorine bleaching process in pulp and paper mills
- Incineration of Polychlorinated Biphenyls (PCBs)
- Wood preserving with pentachlorophenol (as impurity of PCP)

SOURCES OF ENTRY INTO THE ENVIRONMENT

PCDDs and PCDFs enter the environment from both natural and anthropogenic sources. The four main categories of sources are: combustion, industrial, chemical products and natural.

Combustion Sources

Most significant anthropogenic sources are municipal and medical incinerators with old technology, i.e. lacking scrubbers and other pollution control equipment. Technology to control these sources exists. According to some estimates (Ref.2)[1] these two sources count for 77% of the total US and Canadian airborne emissions.

Chemical Sources

- Most significant sources are: the wood preservative pentachlorophenol (chemical) and pulp and paper mills using chlorine for the bleaching process (industrial).

- Pentachlorophenol is used in Canada to preserve and protect wood mainly for hydro and telephone poles; use has been significantly reduced since 1981; decrease in use will continue as it is replaced by alternative wood preservation products (CCA, ethylene glycol).

- Dioxins are also present in herbicide 2,4-D; their concentration in 2,4-D is strictly controlled.

- A wide variety of commercial chemicals contain dioxins and furans as impurities; none are currently manufactured in Canada; use of these chemicals has decreased considerably over the past ten years; this trend is expected to continue.

Industrial Sources

- Significant source of dioxins and furans is pulp and paper mills; dioxin and furan formation is reduced by changing the production processes and reducing the demand for bleached pulp.

- Most significant source of furans is incineration of PCBs without adequate air and temperature or during an accidental fire. PCBs are subject to strict storage, handling, and inventory controls, and in the last year options are becoming available for the PCB destruction.

Additional Sources

- Possible natural sources are: burning wood in stoves and fireplaces, barbecuing,

cigarette smoke.

- Natural combustion sources include forest fires and volcanoes and they cannot be controlled or limited.

TABLE 1: ESTIMATED AIR EMISSIONS FOR PCDDs AND PCDFs (REF. 2)

POTENTIAL SOURCE	ESTIMATED AIR RELEASE (TEQ) gr/year[1] (Min - Max)
Municipal Solid Waste Incineration	0.70 - 5.5
Incineration (Sewage Sludge)	0.32 - 9.7
Hazardous Waste Incineration	0.54 - 5.40
Medical Waste	8.00 - 68.0
Iron Sintering	5.40 - 54.0
Secondary Copper Smelting	6.10 - 61.2
Cement Kilns - Burning Hazardous Waste	9.30 - 93.0
Cement Kilns - Without Hazardous Waste	3.64 - 36.4
Coal Combustion - Entire Province	0.80 - 7.7
Wood Combustion - Entire Province	3.40 - 34.0
Mobile Sources - Diesel Fuel	0.25 - 2.50
Mobile Sources - Unleaded Gasoline	0.006 - 0.06
Mobile Sources - Leaded Gasoline	0.003 - 0.30
TOTAL	**38.5 - 377.0**

*1 TEQ - Toxic Equivalent

FATE, CONCENTRATION, TOXICITY

1. Bioaccumulation

Dioxins and furans readily bioaccumulate in fatty tissues. The most lipophilic and most stable are the 17 very toxic 2,3,7,8 isomers. Due to considerable accumulation in biological tissue they are found in most species of wildlife surveyed. They appear in the natural and human food chain; all Canadians have detectable concentrations in their body fat as is the case in populations of most industrialized countries. They are highly concentrated in body fat and in fatty organs (e.g. liver) and are also excreted in breast milk.

2. Persistence (half life)

Dioxins and furans are very persistent: 2,3,7,8-tetrachloro-dibenzo-dioxin (2,3,7,8-TCDD) is the most toxic dioxin, i.e. the one most predominantly adsorbed and retained in tissue. 2,3,7,8 TCDD has a half-life of 10 years or longer.

Distribution in the environment:

Dioxins and furans generally attach to particles. They are not mobile through sediment and soil. They are widely distributed in air, water and soil, but they most significantly accumulate in soils and sediment.

3. Toxicity

2,3,7,8-TCDD and other dioxins with substitution in the 2,3,7,and 8 positions are extremely toxic to mammals.

- Long term exposure to 2,3,7,8-TCDD can activate enzymes or lead to tissue damage, affect reproduction, cause developmental deformities in the fetus, cause cancer
- Exposure to dioxins does not appear to cause damage to genetic material and chromosomes
- The no-observed-adverse-effect-level for 2,3,7,8-TCDD for chronic exposure in rats (cancer and reproduction) is approximately 1 nanogram per kilogram of body weight per day
- Birds and fish seem to be more sensitive than most mammals to acute exposure to dioxins

- Dioxins and furans that are not substituted in the 2,3,7, or 8 positions are far less toxic and are far less capable of activating enzymes

The toxic potency of the PCDD/PCDF congeners is commonly expressed in terms of Toxic Equivalent Factors (TEF), i.e., the toxic potency of a given congener relative to that of 2,3,7,8-tetra-chloro-dibenzo-p-dioxin (2,3,7,8 TCDD), which is the most toxic congener. The overall toxicity of a mixture of PCDD and PCDF congeners can be expressed quantitatively by using their respective TEFs to compute the amount of 2,3,7,8-TCDD that is equivalent in its toxicity to that of the mixture. This quantity is expressed as amount of toxic equivalents (TEQ). The internationally accepted TEFs are shown below:

COMPOUND		TEF
Dioxins:	2,3,7,8-TCDD	1.0
	1,2,3,7,8- PeCDD	0.5
	All 2,3,7,8 - HxCDDs	0.1
	1,2,3,4,6,7,8 - HpCDD	0.01
	OCDD	0.001
Furans:	2,3,7,8 - TCDF	0.1
	2,3,4,7,8 - PeCDF	0.5
	1,2,3,4,7,8 - PeCDF	0.05
	All (4) 2,3,7,8 - HxCDFs	0.1
	All (2) 2,3,7,8 - HpCDFs	0.01
	OCDF	0.001

Annual Average Ambient Air Concentrations (pg/m^3)[1]

	DIOXINS (1989/1993)	FURANS (1989/1993)
Toronto	1.7 - 1.0	1.5 - 0.7
Windsor	7.0 - 1.5	11.5 - 2.0
Dorset	2.0 - 0.3	0.3 - 0.1

Historical Contamination - Hot Spots

Love Canal: Dioxins were found in the leachate from a chemical waste landfil.

REGULATIONS TO CONTROL RELEASES/SOURCES

Federal

- The National Incinerator Testing and Evaluation Program (NITEP) monitors emissions.
- Pulp and Paper Mill Defoamer and Wood Chip Regulations, under CEPA.
- Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations, under CEPA.

Province of Ontario

- Effluent Monitoring and Limits Regulation for the Pulp and Paper Sector
- Effluent Monitoring and Limits Regulation for the Petroleum Refining Sector
- Effluent Monitoring and Limits Regulation for the Organic Chemicals Manufacturing Sector
- Effluent Monitoring and Limits Regulation for the Inorganic Chemicals Sector

Air emissions	15 pg/m³ at P.O.I.	MOEE - Guideline
Ind. effluent	Non-measurable (< 35 ppq TEQ)	MOEE - MISA regulations

ENVIRONMENTAL STANDARDS (regulations/guidelines)

MEDIUM	LIMITS/ GUIDELINES	AGENCY
Fish Tissue	15 ppt TEQ	(Guide to Eating Ontario Sports Fish (MOEE))
Drinking Water	15 ppq TEQ	Ontario Drinking Water Objective
Ambient Water	0.3 ppq TEQ	USEPA Water Quality Objective
Soil - Landfarms	10 ppt TEQ	USEPA
Food Packaging	1-2 ppt TEQ	U.S. Pulp&Paper Industry

RELATED GOVERNMENT PROGRAMS/INITIATIVES

- Federal Dioxin/Furan Task Force
- Wood Preservation SOP
- Iron and Steel SOP
-Thermal Power Generation (SOP)

INDUSTRY INITIATIVES

Pulp and Paper industry

By reducing chlorine use in their processes, Pulp and Paper mills in Ontario have noticeably reduced their production of dioxins and furans. ARET report for 1993 shows 98% reduction since the base year 1988 as an average for pulp and paper mills in Canada.

Petroleum Refining Industry

Two of the seven Ontario refineries have installed carbon filters on the scrubbers effluent to ensure that PCDDs and PCDFs, which may be generated during the catalyst regeneration process, do not enter refinery effluent.

PROGRESS TO DATE

ARET report contains annual emissions for 1993 (0.41 Kg) and estimates for year 2000 (0.005).

POTENTIAL PARTNERS/ISSUES

Potential partners are identified in Table 2 .

PROPOSED ACTIONS/PRIORITIES FOR 1996/97

See Table 2.

TABLE 2: PCDDs AND PCDFs RELEASES, POTENTIAL PARTNERS AND ACTIONS

POTENTIAL SOURCE	ESTIMATED RELEASE TEQ G/YEAR*	POSSIBLE PARTNERSHIPS	ACTIONS FOR 1995
Municipal Solid Waste Incineration	0.7 - 5.5	Hamilton MWC - Hamilton Peel MWC - Brampton Vctoria Hospital - London General Motors - Oshawa	Find out more about these plants: - What are they burning? - Are there any recycling programs for plastics in the area? - Are there any emission data ? - Process Conditions (High T)?
Incineration (Sewage Sludge)	0.32 - 9.7	Ashbridges Bay - Toronto Highland Creek - Toronto Hamilton London	- Confirm the info - emission data? - Programs in place to prevent toxics from getting into the sewer? - Education programs? - Contact MISA Municipal for info
Hazardous Waste Incineration	0.54 - 5.40	Laidlaw - Sarnia	- Emission Data? - Discuss with MOEE Waste Reduction Branch (WRD) - Process Conditions (High T)?
Medical Waste	8.00 - 68.0	Ontario Hospitals	- Identify medical incinerators - Sources of PCDDs and PCDFs? - What is being burned-any sorting of materials? - work with the MOEE-WRB
Iron Sintering	5.4 - 54.0	Stelco - Hamilton Algoma - Wawa	- Confirm releases-any emission data? - Review what is being burned - Process Conditions (High T)
Secondary Copper Smelting	6.1 - 61.2	Wolverine - London	- Verification
Cement Kilns - Burning Hazardous Waste	9.3 - 93.0	Canadian Portland Cement Association (CPCA) St. Lawrence - Mississauga	- What are they burning? - Are there any emission data? - Process Conditions (High T)?

Cenment Kilns - Not Reporting Hazardous Waste	3.64 - 36.4	CPCA St. Mary's - Bowmanville St. Mary's - St. Mary's Federal White - Woodstock Lafarge Can. - Woodstock Lafarge Can. - Bath Essrock Can. - Picton	- What are they burning? - Are there any Emission Data? - Process Condition (High T)
Coal Combustion (Entire Province)	0.8 - 7.7	Ontario Hydro (OH)	- Emission data from Ontario Hydro - Does OH have data for other coal combustion sources in Ontario.
Wood Combustion (Entire Province)	3.4 - 34.0	Suggestions by CWG	?
Mobile Sources (Diesel Fuel)	0.25 - 2.50	CPPI Ministry of Transportation (MTO)?	- CPPI to provide info/emission data where available - Investigate if MTO is a partner -Peter Wong's group has data?
Mobile Sources (Unleaded Gasoline)	0.006 - 0.060	CPPI, MTO?	Same as above,
Mobile Sources (Leaded Gasoline)	0.003 - 0.300	CPPI, MTO?	Same as above.

14.0 REFERENCE LIST

1. Air Quality in Ontario (MOEE, 1993)

2. Quantitative Estimation of the Entry of Dioxins, Furans and Hexachlorobenzen into the Great Lakes from Airborne and Waterborne Sources by Mark Cohen, B. Commoner et al., - May 1995.

TIER II PROFILES

Anthracene (see Polyaromatic Hydrocarbon)

Cadmium

1,4 - Dichlorobenzene

3,3'- Dichlorobenzidine

Dinitropyrene

4,4' - Methylene bis(2-chloroaniline)

Pentachlorophenol

Tributyl Tin

Polyaromatic Hydrocarbon (PAH)

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

CADMIUM

This is one of a series of profiles on substances on the COA Tier I/II Target Substance lists for reduction. This profile is intended to:

- *Summarize existing information on Cadmium and its compounds to enable an Action Plan/Plans to be developed for the overall reduction of the substance; and,*
- *As a basis for initiating discussions with stakeholders.*

ENVIRONMENTAL PRIORITY LIST STATUS

- Cadmium and its compounds are on the Tier II list of Toxic substances under **COA**.
- Listed on MOEE's **Candidate Substances for Bans, Phase Outs or Reductions Primary list** (revised 1993)
- Industry reporting is required under **NPRI**.
- **NERM** reporting also required.
- Included in the **U.S. TRI** inventory.
- Included in **ARET** program as an A-2 compound.
- Canadian EPA's **PSL1** designation (toxic).
- Targeted under **U.S. EPA 33/50** program.

DESCRIPTION

Chemical Name (s):	Cadmium; Cd; Cadmium chloride ($CdCl_2$); Cadmium oxide (CdO); Cadmium sulphide (CdS) or greenockite; Cadmium sulphate ($3CdSO_4$-$8H_2O$); Cadmium halide compounds; Cadmium salts of inorganic acids.
CAS No.:	7440-43-9
Chemical Formula:	See above
Molecular Weight:	112.40

Cadmium is a relatively rare chemical element, similar to zinc, with which it is usually associated in nature. It is a silvery-white ductile metal with a faint bluish tinge. It is softer and more malleable than zinc, but slightly harder than tin. Insoluble in water, but very soluble in most acids ($CdCl_2$, 1.40 x 10^6 mg/L at 20°C; CdS, 1.3 mg/L at 18°C; $Cd(OH)_2$, 2.6 mg/L at 25°C).

Melting point:	321°C
Boiling point:	765°C
Vapour pressure:	Negligible

PRODUCTION AND USE

- Cadmium is produced commercially as a by-product from the refining and smelting of zinc ores, which usually contain up to 0.07% recoverable cadmium.
- Cadmium is also recovered from recycling cadmium products or industrial scrap (Environment Canada, ?).
- Canada is the fourth largest producer of refined cadmium (1,963 tonnes in 1992), with 2 major sites in Ontario (Falconbridge-Kidd Creek Division [Timmins] and Algoma Steel Inc.[Sault Ste. Marie]). (NPRI).
- Cadmium's main applications include the following:
  - Electroplating (coatings) of iron and steel, and to a much less extent of other alloys, such as copper and brass - to protect them from corrosion. Due to its cost and the waste disposal problems associated with its toxicity, the use of cadmium in electroplating has decreased to less than half of the present total consumption;
  - Nickel-cadmium batteries are the second-largest application;
  - Colorants and Pigments (orange, yellow, red) used in resins;
  - Polyvinyl chloride (PVC) Heat Stabilizers used in plastics;
  - Low-melting-point alloys and in brazing alloys, solders, and bearings;
  - Television phosphors; telephone and trolley wires; automobile radiators; control rods and shields for nuclear reactors; motor oils; and in curing agents for rubber.

SOURCES OF ENTRY INTO THE ENVIRONMENT

- Natural sources of cadmium include: windblown transport of soil particles, forest fires, and volcanic emissions.
- Globally, anthropogenic activities add approximately 3-10 times more cadmium into the atmosphere than natural sources:
  - **Mining/Smelting/refining** of zinc and other base metal ores;
  - Industrial, commercial, residential **fuel combustion** (stationary sources), including thermal power plants;
  - **Transportation activities** (including fuel combustion, road dust, tire wear);
  - **Incineration** of municipal, industrial, and medical wastes;
  - **Incineration of sewage sludge**;
  - **Effluent discharges** from sewage treatment plants and industrial facilities (mining, iron and steel, electric power generation, metal casting, chemical manufacturing, pulp and paper, & petroleum refining sectors);
  - Cigarette smoke.
- Complete quantitative inventories of cadmium releases from all known or potential anthropogenic sources in Canada are not available.

Table 1: Ontario Cadmium Release Estimate

Sources of Entry into the Environment	Cadmium Releases (kg/yr)				Comments
	Air	Water	Waste	TOTAL	
Mining & smelting of metal ores	18000[a]	723[a]		18723	
Other industries					See sewage treatment plant discharge
Metal Finishing-Electroplating	2000			2000	
Iron and Steel	2000[a]	1460[a]		3460	
Metal Casting	2000[a]	857[a]		2857	
Petroleum Refineries		72[a]		72	
Pulp and Paper		139[a]		139	
Electric Power	1000[a]	55[a]		55	
Inorganic Chemicals		280[a]		280	
Fuel combustion (stationary sources)	9000[a]	N/A		9000	
Incineration					>50% of cadmium in municipal waste stream comes from batteries (EPA, 1987).
Sewage Sludge	3000[a]	N/A	N/A	3000	
Municipal Waste	1000[a]	N/A	N/A	1000	
Medical Waste	50			50	
Hazardous waste	50			50	
Transportation Sector					60% of total emissions of Cd in Windsor area attributed to road dust (MOEE, 1994).
Road	1000			1000	
Rail/Marine	1000			1000	
Road dust					
Tire disposal					
Sewage Treatment Plant Discharges		1733.33[b]		1733.33	Estimated loads from 37 Ontario STPs(75% of Ont. Flows -MOEE, 1987))
Emissions from US transboundary sources					
Point Sources	2.8[c]			2.8	
Area Sources	2.6[c]			2.6	
TOTALS	40105	5320	0	45425	

[a] Data as collected in Table 14, Putnam, D.L., 1995.
[b] MOEE, 1988. Thirty-seven municipal water pollution control plants.
[c] MOEE - revised transboundary emission inventory.

FATE, CONCENTRATION, TOXICITY

Probable Fate:

photolysis -	not an important mechanism in determining fate of cadmium compounds
oxidation -	in reducing condition, Cd may precipitate with reduced sulphur to form CdS
hydrolysis -	aqueous solutions of cadmium salts are hydrolyzed to form hydroxide compounds
volatilization -	not known to form volatile compounds
sorption -	important in determining Cd transport, partitioning, and potential for remobilization
other -	organic ligands of biological origin may affect solubility and adsorption

Biological Properties

1. Persistence (half-life)

- Cadmium is highly persistent in all media since it is an element.
- Mobility, bioavailability and residence times vary depending on media.
- Cadmium tends to be more mobile than other metals; it exists predominantly as the dissolved cation in fresh water.
- Atmospheric cadmium is removed by wet and dry deposition; it has short residence time in the atmosphere.

2. Bioaccumulation

- Strong bioaccumulation, and bioconcentration in the food chain.
- Bioconcentration factors in freshwater fish have been reported as high as 30,000X.

3. Toxicity

- Highly toxic to freshwater fish and invertebrates (short and long term tests done).
- Moderately toxic to aquatic vegetation.
- Highly toxic to humans if orally ingested or inhaled (food likely source); kidney damage from chronic ingestion.
- Limited evidence of carcinogenicity (lung and respiratory cancers) in humans but sufficient evidence in experimental animals.

Concentrations in the Environment

- Detected in most environmental media; concentrations reflect the proximity to industrial and urban areas and are considerably higher near smelters.

AIR

- Cadmium concentrations in the Windsor airshed (outdoors) averaged 1.3 ng/m^3 (1991-92).

WATER

- 20% of samples in Ontario (1979-92) for the Provincial Water Quality Monitoring Network exceeded the Objective of 0.2 ug/L (also detection limit).
- Maximum concentrations in Areas of Concern include:
  - 40 ug/L in Jackfish Bay (1991)
  - 15 ug/L in Peninsula Harbour (1991)
  - 7 ug/L in Spanish Harbour (1991)
  - 5 ug/L in Thunder Bay (1991)
  - 1.7 ug/L in Hamilton Harbour (1986)
  - 1.46 ug/L in Toronto's waterfront (1991)
- A survey of Canadian water supplies indicated median cadmium concentrations in raw and distributed waters to be less than or equal to 0.01 mg/l (1979).

SEDIMENT

- Widespread exceedences of Guidelines.
- Maximum concentrations in Areas of Concern include:
  - 41 mg/Kg in the Detroit River (1991)
  - 20.5 mg/Kg in Hamilton Harbour (1989)
  - 19.7 mg/Kg in the Niagara River (1981)
- A maximum value of 13.7 mg/kg for Lake Erie has also been reported (1981)

SOIL

- N/A

REGULATIONS TO CONTROL RELEASES/ SOURCES

Ontario

- Ontario Reg. 337 Ambient Air Quality Criteria: 2.0 mg of Cd per cubic meter of air (24hr criteria).
- Ontario Reg.346 - General Air Pollution: 5.0 mg of Cd in free & combined form per cubic metre of air.

- Ontario Reg. 347 Waste Management - General: Leachate Quality Criteria 0.005 mg/L.
- Ontario Reg. 101 Recycling & Composting of Municipal Waste: 3ppm - Maximum concentration for regular compost (dry weight); 4ppm - Maximum concentration for controlled compost; 1.6ppm resulting in soil from use of controlled compost.
- Provincial Sediment Quality Guidelines: Severe Effect Level value = 10 mg/Kg, Lowest Effect Level = 0.6 mg/Kg (for Ontario)
- Provincial Water Quality Objective (Ontario): 0.2 ug/L (Interim = 0.1 ug/L at 0-100 mg/L Hardness as $CaCO_3$, or 0.5 at >100 mg/L Hardness).
- MOEE's Drinking Water Maximum Acceptable Concentration: 0.005 mg/L.
- Ontario surface soil decommissioning guidelines: 4 ug/g dry weight for Urban areas, and 1 ug/g dry weight for Rural areas (currently being revised).

Canada

- Concentration of total cadmium in irrigation water should not exceed 0.01 mg/L for continuous use on all soils (Environment Canada).
- Recommended Guidelines for Total Cadmium for waters of different hardness to protect aquatic life: 0.2 to 1.8 ug/L.
- Canadian Drinking water guideline: 0.005 mg/L.

U.S.

- U.S. EPA Ambient Water Quality Criteria: 10.0 ug/L; Maximum Contaminant Level for drinking water: 0.005 mg/L.

World

- World Health Organization drinking water guideline: 0.005 mg/L.

RELATED GOVERNMENT PROGRAMS/ INITIATIVES

- Windsor Air Quality Study (1994) - indoor and outdoor air quality in the Windsor airshed.
- CEPA's PSL designation.
- Memorandum of Understanding with the Metal Finishing Sector in Ontario (Pollution Prevention Partnership); Four facilities have completed assessments of their waste sources; 44 metal finishing companies attended a one day workshop.

INDUSTRY INITIATIVES

- Cadmium is reported under NERM (CCPA, 1993)
- Cadmium is reported under NPRI
- Cadmium is reported under MISA's Metal Mining sector regulation (Reg. 560/94).
- Targeted under ARET on the A-2 list.

- Listed on the U.S. TRI inventory.
- U.S. Ford Motor Co. declared that it wants is suppliers to eliminate cadmium-based stabilizers and colorants by 1995 (needs to be confirmed).
- Other companies (e.g. Proctor & Gamble & Kraft General Foods) asking that packaging suppliers provide products free of heavy metals (including cadmium).

POTENTIAL PARTNERS/ISSUES

- Iron & Steel SOP
- Metal Finishing SOP
- Thermal Power Generation SOP
- Ontario Mining Association, Canadian Mining Association and/or Base Metal Mining SOP
- Coal Combustion
- Metal Casting Companies
- Operators of Incinerators (muncipal, industrial, sludge, hazardous waste)
- Sewer users (other than metal finishers)

PROGRESS TO DATE

see Table 2 on page)

PROPOSED ACTIONS/PRIORITIES

- Particpation in above referenced SOPs and initiation of project with Metal Mining Sector
- Ni-Cd battery recycling promotion

REFERENCE LIST

Putnam, David L. *Draft - Sources, Released and Loadings - Preliminary Estimates for COA Substances*. A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261.

TABLE 2: PROGRESS TO DATE

COMPANY	LOCATION	RELEASES (Kg/year)			COMMENTS
		BASE YEAR	1993/94	2000	
Abitibi-Price Inc.	Fort William	1.5	1.5	1.5	ARET
Co-Steel Lasco	Whitby	40	40	20	ARET
Courtice Steel	Whitby	9	9	9	ARET
Dofasco	Hamilton	412	408	408	ARET
Dow Chemical Canada Inc.	Sarnia	11	0	0	ARET
E.B. Eddy Forest Products Inc.	Espanola	4.1	4.1	4.5	ARET
E.B. Eddy Forest Products Inc.	Ottawa/Hull	7.7	7.7	7.7	ARET
Kodak Canada Inc.	Toronto	1	1	0.5	ARET
Natural Resources Canada	Province	3	3	3	ARET
Ontario Hydro	Province	5.6	5.6	5.6	ARET
Stelco inc.	Hamilton	798	798	798	ARET
Stelco Inc.	Nanicoke	110	110	110	ARET
Algoma Steel Inc.	Sault Ste. Marie	3	3	2	NPRI
Falconbridge Ltd.	Sudbury	1500	2500	1300	ARET
Falconbridge Ltd.	Timmins	1800	600	40	ARET, NPRI
Resco Colours	Mississauga		1		NPRI
TOTALS	**16 Sources**	**4705.9**	**4487.4**	**2708.3**	**4.6% reduction since 1988 42% reduction commitments for 2000**

March 28,1996

PRIORITY SUBSTANCE PROFILE:

1,4-DICHLOROBENZENE

This is one in a series of profiles on substances on the COA Tier/II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance(s) and*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- 1,4-dichlorobenzene is listed as an A-2 substance on ARET
- !,4-dichlorobenzeneis listed on MOEE's Bans & Phase Out List
- CEPA PSL Assessment: Non-Toxic

  "Based on these considerations, it has been determined that there is insufficient information to conclude whether 1,4-dichlorobenzene is entering the environment in quantities or under conditions that may be harmful to the environment. It has, however, been concluded that 1,4-dichlorobenzene is not entering the environment in quantities or under conditions that may constitute a danger to the environment on which human life depends, or to human life or health."
- 1,4 - dichlorobenzene is on the NPRI.

DESCRIPTION

Chemical Name(s):	1,4-dichlorobenzene, paradichlorobenzene
CAS No.:	106-46-7
Chemical Formula:	$C_6H_4Cl_2$
Molecular Weight:	147

The organic compound 1,4-dichlorobenzene is commonly referred to as *para*-dichlorobenzene (*p*-DCB), but there are about 20 additional terms used for this chemical. Some of these names include Paramoth, para crystals, and paracide, reflecting its widespread use as a moth killer [8].

It is one of a group of twelve chemically similar substances which differ in the number of chlorine atoms, and their relative positions on the same six-membered carbon atom (aromatic) benzene ring structure [6]. At room temperature these substances can either be in a solid or liquid state. The chlorobenzenes are generally, not soluble in aqueous media and 1,4-DCB is practically insoluble in water [4].

PRODUCTION AND USE

Used primarily as a deodorant (e.g. in "puck" form for urinals and toilets). Another major use is in insecticides and insect repellants. Sale of 1,4-DCB has steadily dereased over the past 20 years in Canada: in 1979 1,865 tonnes of the substance were sold and in 1995 994 tonne were sold [7]. According to another reference, Canadian demand remained steady at 3,500 tonnes per year for the period 1986 through 1991, and was not expected to change over the next five years (1992 through 1996) [11].

Only one Canadian manufacturer of 1,4-DCB is known [8] and this facility is in Napierville, Quebec. Recochem does not actually synthesis DCB but separates it from an imported mixture of chlorinated benzenes.

Sources of Entry into the Environment

1. Industrial: MISA monitoring data for 1989/1991 indicate 179 kg/year from three facilities in chemical manufacturing sector. It is possible that the source may be from its use as sanitization agent at these plants [8] rather than from processing activities. These companies have not since reported DCB emissions to either NERM or ARET.

   NPRI data for 1993 releases indicates only one source (depositing over the 10 tonne reporting threshold). The Napierville Refinery in Napierville, Quebec, released 24.8 tonnes to water in 1993 [8].

2. Domestic: It has been estimated [8] that over 90% of 1,4-DCB use is for domestic sanitizers and insecticides/repellants. Based on sales data for 1995 this translates to a release to the Ontario environment of 340 tonnes released annually. Virtually all is volitilized to the atmosphere.

FATE, CONCENTRATION & TOXICITY

1. Persistence (half life): Some chlorobenzenes are reactive towards hydroxyl radicals in air. Half-life found to be about three days for dichlorobenzenes [6].

Volatilization is dominant mechanism for removal of chlorobenzenes from water column: 300 ug/L 1,4-DCB almost completely removed from aerated distilled water in less than four hours; from unaerated water rates found to be slower with essentially total loss in less than three days [6].

Waste water treatment: degradation by *Pseudomonas*: 200 mg/L 30°C; parent: 100% ring disruption in 92 hours; mutant: 100% ring disruption in 25 hours [10].

2. Distribution in the environment: Ubiquitous in aquatic environment; chlorobenzenes have been detected in water, sediments and aquatic biota [6]. Chlorobenzene has been detected in water monitoring surveys of various U.S. cities. The concentrations reported were as follows: 1.0 ppb in groundwater; 0.1 - 5.6 ppb in raw water contaminated by various discharges; 4.7 ppb in upland water; 8.0 - 17.0 ppb in industrial discharge; and 27 ppb in municipal water [6].

REGULATIONS TO CONTROL RELEASES/ SOURCES

None identified.

OTHER GOVERNMENT PROGRAMS/INITIATIVES

None identified.

INDUSTRY INITIATIVES

1. NERM
2. ARET

POTENTIAL PARTNERS/ISSUES

1. Recochem
2. Federal Government Buildings & Parks
3. Ontario Government Buildings & Parks
4. Municipal Buildings & Parks
5. Public Sector/ Commercial Sector (Property Management Groups)
6. Large Distributor - Loblaws, Canadian Tire, Dominion

PROGRESS TO DATE

COMPANY/SOURCE	LOCATION	RELEASES (tonne/year)			COMMENTS
		Base Year	1993/94	2000	
Domestic Use	Ontario	1,550	1.019	<994	Estmated from sales data (7)
Chrysler Canada	Ontario	0.36	0.36		ARET
Dofasco Inc.	Hamilton	0.206	0		ARET
Dow Chemical Canada Ltd.	Sarnia	0.0004	0		ARET
E.B. Eddy Forest Products Ltd.	Espanola	0.002	0.002		ARET
Natural Resources Canada	Ontario	0.001	0.001		ARET
Rainy River Forest Products Inc.	Kenora	0.001	0.001		ARET
Ontario (6 Facilities contribute to overall drop in sales)					**36% Reduction to date based on sales**

PROPOSED ACTIONS/PRIORITIES

Set up dialogue with Recochem to monitor production and sales data. Initiate dialogue with large distributors, property managers and communities. Environment Canada and MOEE to ensure use of 1,4-DCB is ceased in their buildings and encourage other government departments to do the same.

REFERENCES

1. ATSDR Public Health Statement, January 1989 at inet site: http://atsdr1.atsdr.cdc.gov:8080/atsdrhome.html

2. inet site: http://atsdr1.atsdr.cdc.gov:8080/gsql/

3. EPA Chemical Substance Fact Sheet at inet site: gopher://ecosys.drdr.Virginia.EDU:70/00/library/gen/toxics/

4. Merck Index: An Encyclopedia of Chemicals and Drugs. 11th ed. Martha Windholtz ed.

5. ATSDR ToxFAQs (tm) at inet site: http://atsdr1.atsdr.cdc.gov:8080/tfacts10.html

6. Canadian Water Quality Guidelines, 1992.

7. Personal communication. Marina Kovrig, Vice President, Recochem. February 26,1996.

8. National Pollutant Release Inventory.

9. Sources, Releases and Loadings for COA Substances. D.L. Putnam.

10. Handbook of Environmental Data on Organic Chemicals. Karel Verschueren.

11. Environmental Leaders 1 Voluntary Commitments to Action on Toxics through ARET. March, 1995.

12. CEPA PSL Assessment Report 1,4-Dichlorobenzene.

13. Draft Organic Chemical Manufacturer Sector Best Available Technology Report 1991. SAIC, Art Shattuck.

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

3,3'- DICHLOROBENZIDINE

This is one in a series of profile on substances on the COA Tier II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance; and*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- 3,3'-DCB is on the COA Tier II list
- 3,3'-DCB is on the Aret B-1 list
- 3,3'-DCB is on the MOEE Bans, Phase-outs list
- 3,3'-DCB was assessed under CEPA: TOXIC
  Danger to the environment (Section 11a): No
  Danger to the environment upon which human life depends (Section 11b): No
  Danger to human life and health (Section 11c): Yes

DESCRIPTION

Chemical Formula: $C_{12}H_{10}N_2Cl_2$

CAS No.: 91-94-1

Synonyms: 4,4'-diamino-3,3'-dichlorobiphenyl
o,o'-dichlorobenzidine
3,3'-dichlorobiphenyl-4,4'-diamine
3,3'-dichloro-4,4'-diamino(1,1-biphenyl)

Physical Properties:

- Uusually available as the dihydrochloride salt, 3,3'-dichlorobenzidine dihydrochoride ($C_{12}H_{10}N_2Cl_2 \cdot 2HCl$): a stable, grey to purple crystalline solid that does not evaporate
- Molecular weight: 253.13

- Melting point: 133°C
- Relatively low vapour pressure (1.33×10^{-3} Pa at 22°C)
- Low water solubility (4 mg/L at 20°C as the dihydrochloride salt)
- A log n-octane/water partition coefficient of 3.02

PRODUCTION & USE

- 3,3'-DCB does not occur naturally in air, soil or water
- 3,3'-DCB is not produced in Canada, but is imported in quantities up to 100 tonnes annually. In 1989, 109 tonnes of 3,3'-DCB was imported into Canada and 80 tonnes of it went to Ontario.
- Presently, only 1 company (Dominion Colour Corporation) imports 3,3'-DCB into Canada.
- 3,3'-DCB is used primarily as an intermediate in making dyes and pigments for printing inks(largest use), textiles, paints, plastics and crayons
- 3,3'-DCB is used as a curing agent for manufacturing polyurethane elastomers
- 3,3'-DCB is used in a colour test for the presence of gold

SOURCES OF ENTRY INTO THE ENVIRONMENT

- From any stage in the production, storage, transport, use and disposal of 3,3'-DCB-containing materials;
- Possibly by atmospheric and water-borne transport from other countries;
- Largest single release would likely be through direct emissions from plants that manufacture 3,3'-DCB-containing materials;
- 3,3'-DCB-containing pigment wastes and/or use could potentially constitute a wider spread release;
- Loss from polymers would not constitute a significant route of entry since the any residual 3,3'-DCB is very low and firmly bound to the polymer matrix;
- Releases of 3,3'-DCB may occur through incomplete incineration or landfilling of waste materials containing 3,3'-DCB but it is likely that incineration would destroy unreacted 3,3'-DCB
- In 1990, Dominion Colour reported the following losses (from SOP contact):
  - 160 kg of 3,3'-DCB lost through the manufacturing of pigments
  - 214 kg of unreacted 3,3'-DCB within the pigment matrix
- An additional source would be from imported DCB based pigments (contains unreacted pigments in the matrix): DCB-based pigments were being imported into Canadain quantities greater than 300 tonnes (estimate approximately an additional 100 kg of DCB from this source into Ontario at 0.1% unreacted DCB and 33% of the use in Ontario).

FATE, CONCENTRATION & TOXICITY

1. Persistence (half life): Not expected to be persistent: relatively short half-life (i.e. less than a few weeks) in water, soil and air

   Distribution in the environment: About 60% of 3,3'-DCB will eventually end up in water; the rest will be divided about equally between terrestrial soils and aquatic sediments

   No information on the concentrations of 3,3'-dichlorobenzidine in Canadian air, surface waters, ground water, biota, soil or sediment

   Due to its relatively low volatility, very short persistence and low concentrations in the atmosphere, 3,3'-dichlorobenzidine is not expected to contribute to the greenhouse effect, depletion of the ozone layer or the formation of ground-level ozone.

   Strongly bound to soil and is therefore, highly immobile.

2. Bioaccumulation: The concentration of 3,3'-DCB found in fish tissues is expected to be somewhat higher than the average concentration of 3,3'-dichlorobenzidine in the water from which the fish was taken

3. Toxicity: Possible exposure for workers who manufacture, process, and package 3,3'-DCB are breathing of 3,3'-DCB suspended in air and skin contact with the chemical

   Exposure for the general population is most likely by drinking water from wells contaminated with 3,3'-DCB from industrial discharge and waste disposal sites and eating soil contaminated with 3,3'-DCB

   Poisonous gases are produced in fire, including chlorine, nitrogen oxides and benzidine

   3,3'-DCB has high chronic toxicity to aquatic life

   Experimental animals have died after eating, for brief periods of time, very high levels of DCB mixed in their food

   Short-term exposure may cause sore throat, respiratory infections and stomach upset

- Chronic (long-term) health effects:
  - probable carcinogen in humans (i.e. liver, breast, bladder, intestine & skin)
  - may possibly cause reproductive damage in humans
  - has caused cancer in the offspring of animals exposed during pregnancy

- may cause a skin allergy

- When 3,3'-DCB enters the body, very little of it leaves the body unchanged. Most of it (over 90%) is changed to related chemical substances, called metabolites, which leave the body mainly in feces and to a lesser extent in urine within 72 hours.

REGULATIONS TO CONTROL RELEASES/ SOURCES

None Identified

OTHER GOVERNMENT PROGRAMS/INITIATIVES

- A Strategic Options Process (SOP) was completed for 3,3'-DCB and a draft Strategic Options Report is currently under review by the Issue Table members.

INDUSTRY INITIATIVES

None identified

POTENTIAL PARTNERS/ISSUES

- Dominion Colour Corporation
- Pigment Users: Printing and Graphics - MOU;
  Textile Printers;
  Crayon Manufacturing

PROGRESS TO DATE

- The Strategic Option Process resulted in a commitment from Dominion Colour to work with Environment Canada to ensure releases from all parts of their manufacturing process are strictly controlled.

PROPOSED ACTIONS/PRIORITIES

- Meet with Dominion Colour to discuss commitments under SOP and to discuss the availability of the unreacted DCB in pigments to the environment. Alternative colouring agents are available for yellow dyes - how can these be improved to replace DCB?

REFERENCE LIST

1. Government of Canada. *Priority Substance List Assessment Report 3,3'-Dichlorobenzidene*. Canada Communications Group © 1993.
   And *Draft Strategic Options Report - Benzidine and 3,3'-Dichlorobenzidine Issue Table.* January 1996.

2. Putnam, David L. Draft - Sources, Releases and Loadings - Preliminary Estimates for COA Substances. A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261. May 1995.

3. Brian, Ted and Nathalie Tremblay. Contacts on SOP for 3,3'-Dichlorobenzidene.

4. Ontario Ministry of the Environment and Michigan Department of Natural Resources. CESARS: Chemical Evaluation Search And Retrieval System. August 1995.

5. Agency for Toxic Substances and Disease Registry (Atlanta, Georgia). ASTDR Public Health Statement. December 1989. [Internet address: http://atsdr1.atsdr.cdc.gov:8080/stsdrhome.html]

6. University of Virginia:[Internet address: gopher://ecosys.drdr.virginia.edu:70/11/library/gen/toxics/]

March 28, 1996

PRIORITY SUBSTANCE PROFILE

DINITROPYRENE

This is one in a series of profiles on substances on the COA Tier II Target Substance List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance; and*
- *As a basis for initiating discussions with the stakeholders.*

Substance	**CAS No:**
dinitropyrenes (C16H8N2O4)	78432-19-6
1,3-dinitropyrene	75321-20-9
1,6-dinitropyrene	42397-64-8
1,8-dinitropyrene	42397-65-9

ENVIRONMENTAL PRIORITY LIST STATUS

- COA Tier II
- MOEE Secondary List of Substances for Bans, Phaseouts or Reductions (1,8 - dinitropyrene)
- ARET List A-1
- US Strategy for the V.E. of Persistent Toxic Substances in the GLB, Level II Toxic Substances

DESCRIPTION

Isomers:	1,3-dinitropyrene	1,6-dinitropyrene	1,8-dinitropyrene
Molecular Weight:	92.26		
RTECS Number:	UR2455000		
Melting Point	295 - 297 C	309 - 310 C	299 - 300 C
Boiling Point:	sublimes	sublimes	sublimes
Chrystalline form:	orange needles	yellow needles	

PRODUCTION AND USE

- Dinitropyrenes are byproducts formed in combustion processes in an acidic/oxidizing environment (primary precursors: NO2 & HNO3), concurrently with parent PAHs.

- Dinitropyrenes are also formed during post combustion from reaction of parent PAH (100C to 200C) with nitrating species (N_2O_4, HNO_2, HNO_3, NO_2) present in the ambient air and in combustion gases.
- The reactions are electrophilic and the rate of reaction depend on structure, photo-activation, adsorbent media. PAHs can be nitrated or oxidized on particles in the atmosphere by ambient gases.

SOURCES OF ENTRY INTO THE ENVIRONMENT

Nitro-PaH are present in ambient airborne particles and can be generated from both natural and anthropogenic sources:

Natural Sources: Formation of nitroPAHs in high temperature natural processes (forest fires, volcanoes) is possible. Forest fires, volcanoes, seepage from rock formation or tar pits, biological conversion of biogenic precursors are potential sources.

Anthropogenic Sources: Potential anthropogenic sources of nitro-PaH are similar to those of the parent PaH compounds.

Combustion and Incineration:

-occur in diesel and gasoline engine exhausts

- Of the compounds associated with diesel emissions, 1,6-dinitropyrene is a particularly potent mutagen and carcinogen;
- Other mobile sources: railroads, ships, aircraft, farm, military
- Residential heating fireplaces using wood and brown coal briquettes as fuel
- Coal Fly Ash
- Waste Incineration
- Cigarette Smoke, Barbeques

Mobile Source: In diesel exhausts, 1 nitropyrene is the major mutagenic component. Emission factors of 1-nitropyrene (ug/mile) were found for the following source types in decreasing order:

SOURCE		EMISSION FACTORS	
1.	Light Duty Diesel	7.6	
2.	Heavy Duty Diesel	2.4	
3.	Diesel Car	3.2	1.2
4.	Precatalyst Car Leaded Fuel	0.174	0.053
5.	Unleaded Car No Catalyst	0.1	0.09
6.	Catalyst Car	0.046	

The concentration ratio (by weight) of dinitropyrenes to 1-nitropyrene have been found to be as follows:

	Japanese Study	US Study
Diesel Particulate	0.013	.0862 - .1148
Gasoline Particulate	0.56	
Airborne Particulate	0.013 - 0 (heavy traffic)	

Based on the US study on diesel particulate, the concentration of dinitropyrenes ranged from 1403 to 1965 ng/g. Emission levels depend on combustion fuel and several conditions.

It should be noted that technology to reduce PAH may not necessarily reduce dinitropyrenes. One study showed that the level of dinitropyrenes in the exhaust gas increased with the operation of catalytic converters despite the decrease in parent PAHs.

Area Sources:

- Residential heating fireplaces using wood and brown coal briquettes as fuel. Levels of 30 ppm for nitro-pyrene and nitro-BaP were found. When the wood smoke collected was experimentally reacted were O3 and NO2, 1-nitropyrene, 1,6-dinitropyrene and 1,8-dinitropyrene were found;
- Decomposition of used tires;
- Cigarettes smoking (increase nitroPAHs with nitrates).

Industrial Sources:

Coke Oven Production	- Byproduct in air/water releases
Coal Mining	- Esp. solvent refined coals
Petroleum and Fossil Fuel Products	- Byproduct in fuel or air emission
Aluminum Plant	- Byproduct in air emissions
Electric Power Generation	- Coal fly ash and air emissions
Metal Processing	- Scrap Metal
Rubber Products and Tire	- Carbon Black

FATE, CONCENTRATION & TOXICITY

1. Fate

Persistence CESARS Score: 10E

Air: Based on analogy to other PAHs with 4 or more rings which have Log Kow values > 4. Particulate nitro-PaH may undergo dispersion over hundreds of kilometers (long

range transport). Deposition of nitro-PaH is also expected to be similar to those of PaH, mostly found adsorbed to particulate matter. Wet and dry deposition processes are expected to be similar to those of 1.0 um particles. Dry deposition velocities would be in the order of 0.02 to 0.32 cm/s. Photodegradation is likely to be the most important chemical transformation of PAH to nitro-PAH, with PAHs half-lives ranging from 0.4 to 68.1 hours. PAHs are more persistent when bound to particulates.

Water: Based on analogy to other PAHs with 4 or more rings which have Log Kow values > 4. Low solubility in water. Pyrene has a volatilization half-life ranging from 115 hours to 3.2 years, biodegradation half life from 0.6 to 5.2 years under aerobic conditions, photo-oxidation half-life from 8.6 days to 1.2 years.

Sediments: Based on analogy to other PaH compounds with 4 or more rings which will biodegrade slowly in contaminated sediment (T 1/2 GT 100 days), in clean sediment 10 to 400 times slower.
PAHs persist and transform slowly in sediments and are relatively stationary.
Principal removal mechanisms in sediments and soils are volatilization and microbial activity.

Soil: Based on analogy to other PAHs with 4 or more rings which have Log Kow values > 4.

2. Concentration

Nitro-PaH occur in air samples at very low concentrations, generally in the order of 10E-11 g/m3. Nitro-PaH have been detected on suspended particulate matter in air samples.
Collection of nitro-PaH as vapours is rare since the vapour pressures are relatively low compared with the corresponding unsubstituted PaH. The mutagenic activity of nitro-PaH is much higher than the parent compounds, therefore, is a significant contributor to the mutagenicity of ambient air.

Based on a 1994 Ambient Air Study of Nitro PAH in Hamilton and Montreal, the following ambient concentrations for 1-nitropyrene were found:

CITY PHASE	HAMILTON		MONTREAL	
	PART.	GAS	PART.	GAS
Conc. 1-NP (pg/m3)	91.7	1.4	9.4 - 96.3	.2 - .7
% Total PAH	.705		.0005 - .002	
Conc. DNP (pg/m3)*	1.33		.136 - 1.40	

* Estimated DNP concentrations based on .0145 ratio for DNP:1-NPon airborne particulate in Japanese study.

Bioaccumulation CESARS Score: 7E
Based on analogy to other PaH compounds with 4 or more rings which have log Kow values of GT 4.

3. Toxicity

- Posses extremely high carcinogenic and mutagenic activities at very low concentrations;
- Capable of affecting a large variety of cells including human, other mammalian and bacterial;
- 1,6 and 1,8-dinitropyrene are two of the most important direct mutagens (>10E6 revertants/mg by the Ames assay) in the nitro- and oxy-PaH groups; and
- There is little understanding of the toxicity of nitro-PaH directly in man, however, irradiation of erythrocytes (red blood cells) with nitro and dinitropyrenes led to hemolysis.

2. Mutagenicity

Mutation has been found upon exposure of dinitropyrenes on human, animal, and bacterial. The administration of 100 mug 1,6-Dinitropyrene directly to the lungs of male rats showed adduct formation in both lung and spleen lymphocyte DNA. Nanograms can affect overall mutagenicity of particulate samples.

Carcinogen CESARS Score: 10
Based on IARC (listed 2A) probable human carcinogen bioassay data available for 2 species with evidence of direct interaction with genetic material: hamster-embryo, rat-subcutaneous.

Epidemiological studies suggest an association between exposure to diesel emissions and an increased incidence of lung and bladder cancer in humans.

REGULATIONS TO CONTROL RELEASES/ SOURCES

None identified.

RELATED GOVERNMENT PROGRAMS/INITIATIVES

None identified.

INDUSTRY INITIATIVES

- ARET - no releases reported
- CCPA NERM - no releases reported

POTENTIAL PARTNERS/ISSUES

Rail, ships, aircraft, farm machinery, diesel engine manufacturers
Canadian Electric Association (Coal burning), Ontario Hydro
Boilers and incinerators manufacturers
Cottager Associations, solid fuel burning appliances manufacturers, distributors and retailers
Canadian Steel Environmental Association
Canadian Petroleum Products Institute, Oil Recyclers
Engine Manufacturers Association
Motor Vehicles Manufacturers Association
Canadian Standards Association
Ministry of Transport, Transport Canada
Energy, Mines and Resources
Municipalities
Lung Association

PROGRESS TO DATE

More studies required on sources and formation and how to reduce its formation.
Several toxicity/mutagenicity studies conducted but few on sampling from sources.

McMaster and Carlton Universities and DOE-RRETC conducted some studies on nitroPAHs.

PROPOSED ACTIONS/PRIORITIES

Due to limited information on this substance, it is recommended that data and reductions be sought with sources identified for PAHs since DNPs are part of the Polycyclic Aromatic Compounds (PAC) group.

Transportation sector, wood burning equipment and incinerator manufacturers, steel sector, fuel manufacturers, engine manufacturers appear to be important partners. Make affected sectors aware of their generation of this substance through existing programs, eg. SOP, P2.

Encouraging reduction in particulate and NOx from combustion sources may reduce some dinitropyrenes since a higher percentage of DNPs appeared to be found on particulates. Reducing PAHs may also result in reducing dinitropyrenes depending on the technology applied. Note that some PAH control technologies (cat. converters) can cause an increase in nitroPAHs emissions.

To inventory DNP, require additional research or lit. search on DNP emissions from stationary combustion sources, correlation of DNP emissions with PAH or 1-NP emissions from sources, survey on DNP in ambient air within GLB - urban and rural, survey on DNP in liquid effluents, surface water, soils, and sediments. (literature search underway)

REFERENCES

1. Fellin, P., Davis C.S., Fradkin R., Concord Scientific Corporation, "A Critical Review of Nitro- and Oxy-PaH Compounds in the Atmosphere, CSC J514", March 1985

2. Kagan, J., University of Illinois, Chicago, Wang, T.P., Benight, A.S., Tuveson, R.W., Wang, G.R. Fu, P.P., Chemosphere, 1990, v20, n5, p453 (14) research article

3. Fullerton, N.F., Smith, B.A., Aidoo A., Heflich R.H., Beland, F.A., "DNA Adduct Formation in Relation to Lymphocyte Mutations and Lung Tumor Induction in F344 Rats Treated with the Environmental Pollutant 1,6-Dinitropyrene", Environmental Health Perspectives, March 1993, v99, p277-280.

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

4,4'-METHYLENEBIS(2-CHLOROANILINE) (MOCA)

This is one in a series of profile on substances on the COA Tier II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance and;*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- MOCA Is on ARET A-1 list; The ARET secretariat has received a general request for review
- MOCA is listed on the NPRI:
- MOCA is on the US TRI

DESCRIPTION

CAS No.: 101-14-4
Chemical Formula: $CH_2(C_6H_4ClNH_2)_2$

Alternate Names: 3,3'-dichloro-4,4'-diaminophenylmethane
p,p'-methylene-bis (o-chloroaniline)
4,4'-methylenebis (2-chlorobenzenamine)
MBOCA; Bis Amine; Cyanaset; DACPM; MOCA

Physical Properties

Molecular Weight: 269
Melting Point 99-107^{0}C
Specific Gravity: 1.44
Composed of colorless crystals or tan colored pellets

- Commercially available in pellet, liquid, and granular form and as a premixed compound with polyhydric alcohols

Soluble in alcohol, ether, most organic solvents, and lipids
Slightly soluble in water

When heated to decomposition, it emits toxic fumes of hydrochloric acid and other chlorinated compounds as well as nitrogen oxides (NOx)

Chemical Properties

Violently reacts with chemically active metals (such as potassium, sodium, magnesium and zinc)

PRODUCTION AND USE

- MOCA is not produced in Canada but is imported
- MOCA is used as a curing agent in urethanes and epoxy resins systems containing isocyanates;
- Used to manufacture products such as polyurethane foams, rubber moldings, gun mounts, jet engine turbine blades, radar systems and home appliances; and
- More common production articles include wheels in skateboards, inline skates, and plastic wheels (fridges, chairs, etc.).
- USEPA 1983 reports indicate that US manufacturers no longer produce this substance
- Only known importer in Canada is a company called Marubeni (located in Toronto)
- It is estimated that several thousand tonnes of MOCA is used each year

SOURCES OF ENTRY INTO THE ENVIRONMENT

- Possible emissions into waste gases and wastewater from plants when substance used as a curing agent.
- Releases reported in 1993 NPRI by Thomson Gordon in Burlington, Ontario
- This facility is a primary producer of fabricated rubber products as well as producing plastic products, mechanical power transmission equipment, gaskets, packing and sealing devices, as well as specialty industrial machinery.
- Based on prorated data from the TRI (U.S) an estimated release to the Ontario environment of 602 kg/year has been estimated from the plastic, tire, rubber products and fabricated metal products manufacturing sectors,

FATE, CONCENTRATION & TOXICITY

1. Persistence (half-life)

- Moderately persistent with a half-life of between 20 to 200 days;
- Chemical properties of MOCA indicate that about 43% will enter the water, 28% in

aquatic sediments, and 30% in soil.

2. Bioaccumulation

- Only speculation that concentrations found in fish tissues are somewhat higher than the average concentration in the water from which the fish was taken.

3. Toxicity and Carcinogenicity

- High acute toxicity to aquatic life; however, there is insufficient data to evaluate or predict the short-term effects on plants, birds, or land animals;
- Sufficient evidence for the carcinogenicity in experimental animals;
- Inadequate evidence for the carcinogenicity in humans; and
- Hi gh and repeated exposure may affect the kidneys, causing a low blood count and cause bloody urine.

REGULATIONS FOR THE CONTROL OF RELEASES/ SOURCES

None Identified

OTHER GOVERNMENT PROGRAMS/INITIATIVES

None Identified

INDUSTRY INITIATIVES

None Identified

PROGRESS TO DATE

None identified

POTENTIAL PARTNERS

Fabricated Rubber and Tire Products Manufacturers
Plastic Products Manufacturers
Fabricated Metal Products Manufacturers
Gaskets, Packing and Sealing Devices Manufacturers
Mechanical Power Transmission Equipment Manufacturers

Known User

Thomson Gordon - Burlington, Ontario

Known Importer

Marubeni Canada Ltd.,Toronto, Ontario

PROPOSED ACTIONS/PRIORITIES

Confirm use quantities and identify importers. Initiate discussion with potential users re the quantities used and the potential substitution.

REFERENCES

1. University of Virginia
Internet Site "gopher://ecosys.drdr.virginia.edu: 70/11/ library/ gen/ toxics"
Internet Site "gopher://gopher.niehs.nih.gov:70/11/ntp/94-carcinogens"

2. Putnam, David L. *Draft Sources, Releases, and Loadings- Preliminary Estimates for COA Substances*. Prepared for Environment Canada - Ontario region under contract KE-409-4-0261. May 1995.

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

PENTACHLOROPHENOL

This is one in a series of profiles on substances on the COA Tier I/II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance(s) and;*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- PCP is on the COA Tier II list;
- Is on the Ontario Ministry of the Environment and Energy list of Bans, Phase-outs and Reductions-Multimedia, 1993 version; and
- Is on the Toxics Release Inventory and Accelerated Reduction and Elimination of Toxics List A-1 (virtual elimination)

DESCRIPTION

Chemical Formula: C_6HCl_5O

CAS No : 87-86-5

Synonyms: Chlorophen; Cryptogyl Ol; Dowicide 7; Dowicide G; Penchlorol; Penta; PCP; Santobrit; Santophen; Santophen 20; Witophen P

Physical-Chemical Properties:

Molecular Weight:	266.34
Melting Point:	191^{0}C
Boiling Point:	309-310^{0}C
Vapour Pressure:	2.4 x 10^{-3} kPa at 30^{0}C
Water Solubility:	5.6 x 10^{-5} mol/L at pH 5.1 and 25^{0}C
Dissociation Constant (25^{0}C):	1.2 x 10^{-5}
pKa:	4.8 - 5.0
octanol/water partition coefficient log P_{ow} :	5.01

PRODUCTION AND USES

- Does not occur naturally in the environment;
- Agriculture Canada restrictions in 1981 limited the use of PCP for preservation of wood products outdoors;
- PCP was last manufactured in Canada in 1983;
- It is now obtained from one of two U.S manufacturers (Vulcan Materials Co., in Birmingham, Alabama and KMG-Bernuth Inc. in Houston, Texas who supply it in the form of solid blocks;
- Currently registered under the federal Pest Control Products Act as a wood preservative and biocide;
- Available as pentachlorophenol or as the sodium salt;
- PCP-oil mixtures are used for pressure treatment of wood products such as telephone and electrical utility poles, railroad ties, posts and construction timbers;
- About 90% of all PCP is used for utility pole preservation,

SOURCES OF ENTRY INTO THE ENVIRONMENT

- PCP may enter the environment from treated wood, industrial discharges, municipal waste treatment plant discharges, spills, or agricultural runoff;
- Estimates of releases to water from the pulp and paper sector according to the MISA monitoring data (1990) and information reported to ARET (ARET, 1995) are 5 kg/yr;
- Estimates of releases to air, water and land for 4 plants in Ontario based on average release-per-facility calculated from data reported to the U.S. TRI for 1992 by 39 wood preserving plants are 700 kg/yr, 9 kg/yr and 100 kg/yr respectively;
- ARET baseline value of 7.7 kg/yr was reported in the first COA progress report;
- A 48% reduction in emissions was reported in 1993 in the first COA progress report;
- According to the 1991 Ontario Hydro report "The Environmental Persistence and Migration of Wood Preservatives".

FATE, CONCENTRATION, TOXICITY

1. Persistence (half-life):

- Moderately persistent in water, with a half-life of between 20 to 200 days;
- May be readily photodegraded under appropriate conditions;
- In general, most studies relevant to aquatic systems support a half-life for PCP of approximately 100d, with higher temperatures and aerobic conditions favouring more rapid breakdown; and
- PCP may persist for extended periods of time in sediment.

Distribution in the Environment:

- about 48% of PCP will eventually end up in terrestrial soil; about 45% will end up in aquatic sediments;
- about 5.3% will end up in water; and about 1.4% will end up in air.

2. Bioaccumulation

- Although chlorophenols are usually substantially diluted upon entry into the aquatic environment, their limited chemical stability and persistence may result in a moderate degree of bioaccumulation in aquatic organisms;
- Reported ratios of PCP concentrations in fish tissue to concentrations in water (bioconcentration factors) have ranged from 10 to 1640; and
- The relatively low bioaccumulation factor for PCP results from the ability of fish to rapidly excrete PCP and its metabolites.

3. Toxicity

- Acute toxic effects may include the death of animals, birds or fish;
- PCP has high acute and chronic toxicity to aquatic life;
- The toxicity of PCP to aquatic life increases as the pH of the water decreases; and
- Chronic toxic effects may include shortened lifespan, reproductive problems, lower fertility, and changes in appearance of behaviour.

Concentration in the Environment:

- Survey of sediment quality in the harbour area surrounding the Northern Wood Preservers facility in 1988 showed that of the 75 points tested, all but 13 displayed levels ranging from 100 ng/g to below detection limits (the remaining 13 had significantly higher concentrations, with levels peaking at 12893 ng/g and 37586 ng/g).

1. Field measurements of soils near PCP poles installed for about one month were variable. One pole had PCP levels in the range of several hundred mg/kg in the core next to the pole, while two other poles were barely above the detection limit.

2. Soil sampling results near three year old poles were variable. The highest PCP levels were found at a depth of 0-30 cm, in the core adjacent to the pole. The highest value was 1040 mg/kg. Two other poles had levels of 4 and 17 mg/kg at this location.

3. Soil concentrations near eight year old poles were consistent, with shallow (0-30 cm) near pole levels of 43-111 mg/kg. Farther out and down, PCP levels were much lower, and at a 100 cm distance, were below detection.

4. Two sixteen year old poles had relatively high PCP levels and one had very low levels. These poles all showed low, but significant levels of PCP at distances of 30 and 100 cm from the poles. Highest concentrations, 0.14 - 550 mg/kg, were again at the pole, and in the upper soil layers.

REGULATIONS TO CONTROL RELEASES/ SOURCES

Regulations:

Pulp and Paper Mill Defoamer and Wood Chip Regulations under CEPA
Maximum acceptable concentration in drinking water as defined by Health and Welfare Canada

Guidelines and Objectives:

- PCP and PCP Thermal Woodpreservation Facilities - Recommendations for Design and Operation;
- Canadian Council of Resource and Environment Ministers for protection of aquatic life;
- International Joint Commission for Great Lakes waters; and
- Ontario Ministry of the Environment for protection of aquatic life

OTHER GOVERNMENT PROGRAMS/ INITIATIVES

- PSL assessment reports for hexachlorobenzene (HCB), and dioxins and furans determined that these substances are "CEPA toxic" and identified PCP as a significant source of these substances;
- The wood preservation sector has been identified in the PSL assessment reports as a source of release of five "CEPA toxic" substances which includes HCB and dioxins and furans;
- The federal government has initiated a sector-based SOP on wood preservation to prepare recommendations to prevent or manage the release of "CEPA toxic" substances from this sector;
- PCP will be managed as a Track 1 substance under the Toxic Substances Management Policy based on its inherent properties (the presence of HCB and dioxins and furans as micro-contaminants);
- The decision to manage PCP as a Track 1 substance would mean that PCP treated products would be managed such that there would be no measurable release of HCB or dioxins and furans to the environment (virtual elimination); and
- If virtual elimination cannot be achieved then there will be no generation - no use of PCP and the treated product.

INDUSTRY INITIATIVES

- Is on the Canadian Chemical Producers Association (CCPA) National Emissions Reduction Masterplan (1993)

POTENTIAL PARTNERS/ISSUES

Wood Preservation SOP
Wood Preservation Sector
Ontario Hydro
Bell Canada

PROGRESS TO DATE

COMPANY	LOCATION	RELEASES (Kg/year)			COMMENTS
		Base Year	1993/94	2000	
Dofasco Inc.	Hamilton	3.7	0	0	ARET
E.B. Eddy Forest Products Inc.	Espanola	4	4	0.4	ARET
Guelph Utility Pole	Guelph	70000	700		P4 Program
TOTAL	**1 Facility**	**70007**	**704**		**90 % Reduction**

PROPOSED ACTIONS/PRIORITIES

Actively participate in the Wood Preservation SOP.

REFERENCES

1. Putnam, David L. *Draft - Sources, Released and Loadings - Preliminary Estimates for COA Substances.* A report prepared for Environment Canada - Ontario Region under contract KE409-4-0261.

March 28, 1996

PRIORITY SUBSTANCE PROFILE:

TRI-N-BUTYL TIN COMPOUNDS

This is one in a series of profiles on substances on the COA Tier/II Target Substances List for Reduction. This profile is intended to:

- *Summarize existing information on the substance to enable an Action Plan/Plans to be developed for overall reduction of the substance(s) and*
- *As a basis for initiating discussions with the stakeholders*

ENVIRONMENTAL PRIORITY LIST STATUS

- Tributyl tin is listed on ARET as an A-1 substance
- Tributyl tin is listed on the MOEE's Bans and Phase out list
- Non-pesticidal Organotin Compounds were assessed under CEPA : NON-TOXIC However, the Ministers have concluded that it is not possible to assess whether any of the non-pesticidal organotin compounds constitutes a danger in Canada to human life or health as defined under Paragraph 11(c) of CEPA.

DESCRIPTION

CAS No.: 106-46-7

There is few data on the physical and chemical properties of non-pesticidal organotin compounds.

PRODUCTION AND USE

Tributyl tin oxide (TBTO) is used in slimicides for use in cooling water towers; anti-fouling agents for use in marine paints; and in wood preservatives [1]. Tributyl tin fluoride (TBTF) is only used in the marine paint application [1].

Only one manufacturing location for organotin compounds is known to exist in Canada,

where, at this facility DBTO is converted to DBT dilaurate [1].

SOURCES OF ENTRY INTO THE ENVIRONMENT

Anthropogenic:

1. Industrial

Manufacturing of polyvinyl chloride (PVC) resins stabilized with organotin compounds may release, but quantities are unknown [1]. In U.S. an estimated 0.5% of the 54,000 kg production is lost to the environment by disposal routes at manufacturing source [1].

Information on landfill leachate or incineration effluent losses to the environment is unavailable [1].

2. Domestic

It has been estimated that 59,000 kg of organotin compounds are released to the environment by anitfouling coatings on marine craft in the U.S. over the three-year life-time of the application [1]. Greatest potential for direct contact with aquatic environment is through its biocidal use in paints, etc. [1].

Landfill and incineration used to dispose of an estimated 2,300 tonnes organotin compounds in PVC annually in U.S. [1].

All organotin compounds currently used in Canada are imported [2].

It is estimated that 30% of PVC products are stabilized with organotin compounds.
In 1985, 1020 tonnes of butyl tin compunds were exported into Canada; of this 405 tonnes went ot PVC pipe, and 615 tonnes went ot PVC siding and profiles (moulds).

FATE, CONCENTRATION & TOXICITY

1. Persistence (half life):

Very little known or available on forms and fate of organotin compounds in aquatic environment [1]. Primary mechanisms for controlling persistence of tri-n-butyl tin compounds in aquatic systems are photolysis in the water and biological degradation in water and sediment. Half-life ranging to several months is expected [1].

2. Distribution in the environment:

Butyltin compounds in the environment were primarily degradation products of the pesticide Tributyltin, the antifouling uses of which has been subject to revised registration requirements in Canada since 1989.

Leaching of organotin-stabilized PVC pipe by water could also be a source of organotin entry into the Canadian environment.

REGULATIONS TO CONTROL RELEASES/ SOURCES

Registristration requirements under the Pest control Products Act

OTHER GOVERNMENT PROGRAMS/INITIATIVES

None Identified

INDUSTRY INITIATIVES

None identified

PROGESS TO DATE

None quantified or identified.

POTENTIAL PARTNERS/ISSUES

1) Canadian Chemical Manufacturers Association members
2) PVC Manufacturers - especially smaller companies
3) Marine Paint manufacture
4) Chlorine Reduction Coordinating Committee
5) Pesticide Review Committee

PROPOSED ACTIONS/PRIORITIES

Confirm use of butyltin quantities for PVC through consultation with the Chlorine Reduction Coordinatoing Committee.

Confirm elimination of tributyltin from marine applications.
Confirm

REFERENCES

1. Canadian Water Quality Guidelines, 1992.

2. Sources, Releases and Loadings for COA Substances. D.L. Putnam.

3. CEPA PSL Assessment Report Non-pesticidal Organotin Compounds.

4. Environmental Leaders 1 Voluntary Commitments to Action on Toxics through ARET. March, 1995.

5. Chemical Evaluation Search And Retrieval System. Ontario Ministry of the Environment and Michigan Department of Natural Resources.

6. Draft Organic Chemical Manufacturer Sector Best Available Technology Report 1991. SAIC, Art Shattuck.

7. Fact Sheet - Chemicals in the Environment: Organotin Compounds in the Aquatic Environment. Environment Canada. Environmental Protection Service - Pacific & Yukon Region. March, 1995.

9. Merck Index: An Encyclopedia of Chemicals and Drugs. 11th ed. Martha Windholtz ed.

TD
420
.T54
1996

Tier I and II substance profiles per Canada - Ontario agreement respecting the Great Lakes basin.

78402